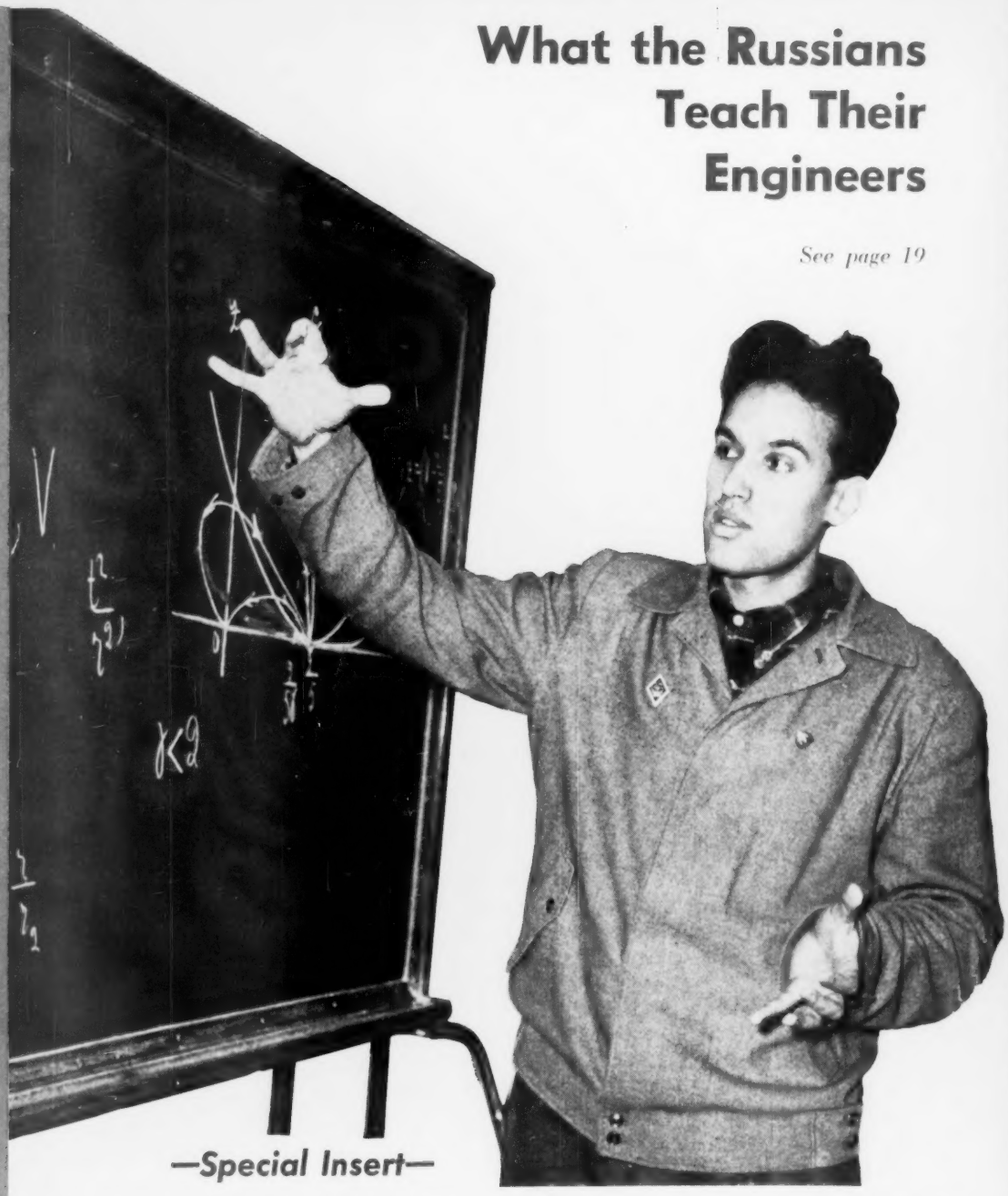
The Magazine of the Registered Professional Engineer

American Engineer

NOVEMBER 1959

What the Russians Teach Their Engineers

See page 19



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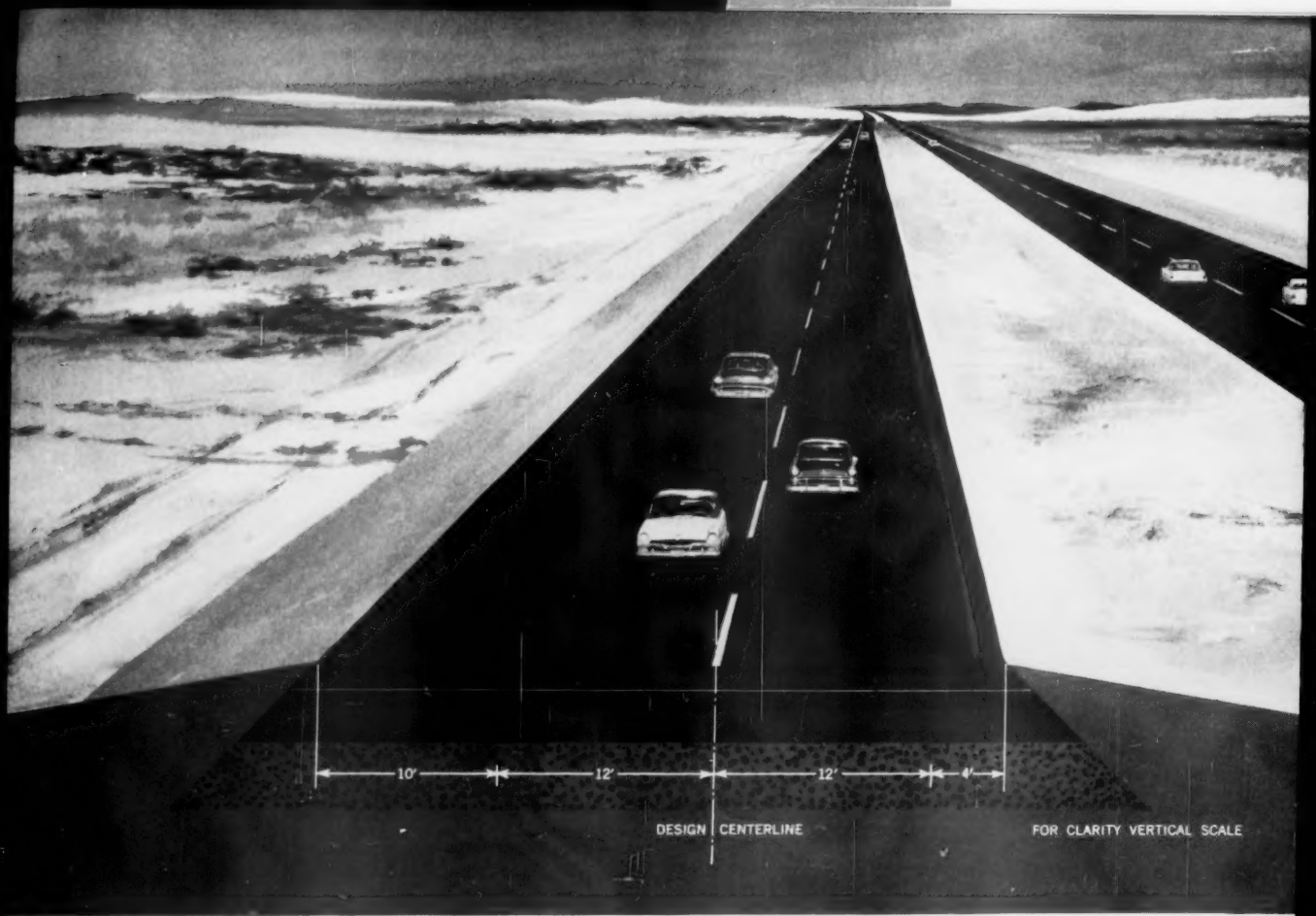


Arizona's First Interstate

Experience with veteran 2-lane Asphalt

Arizona is a big state with a low population density—which means it needs plenty of roads. But there aren't millions of Arizonans to pay for them. Every dollar counts.

These are some of the reasons why most of Arizona's roads traditionally have been of economical Asphalt construction. Time and again, since the State began to pave, Asphalt pavements have stretched available funds over more and more of these long Arizona miles than could any other pavement type.

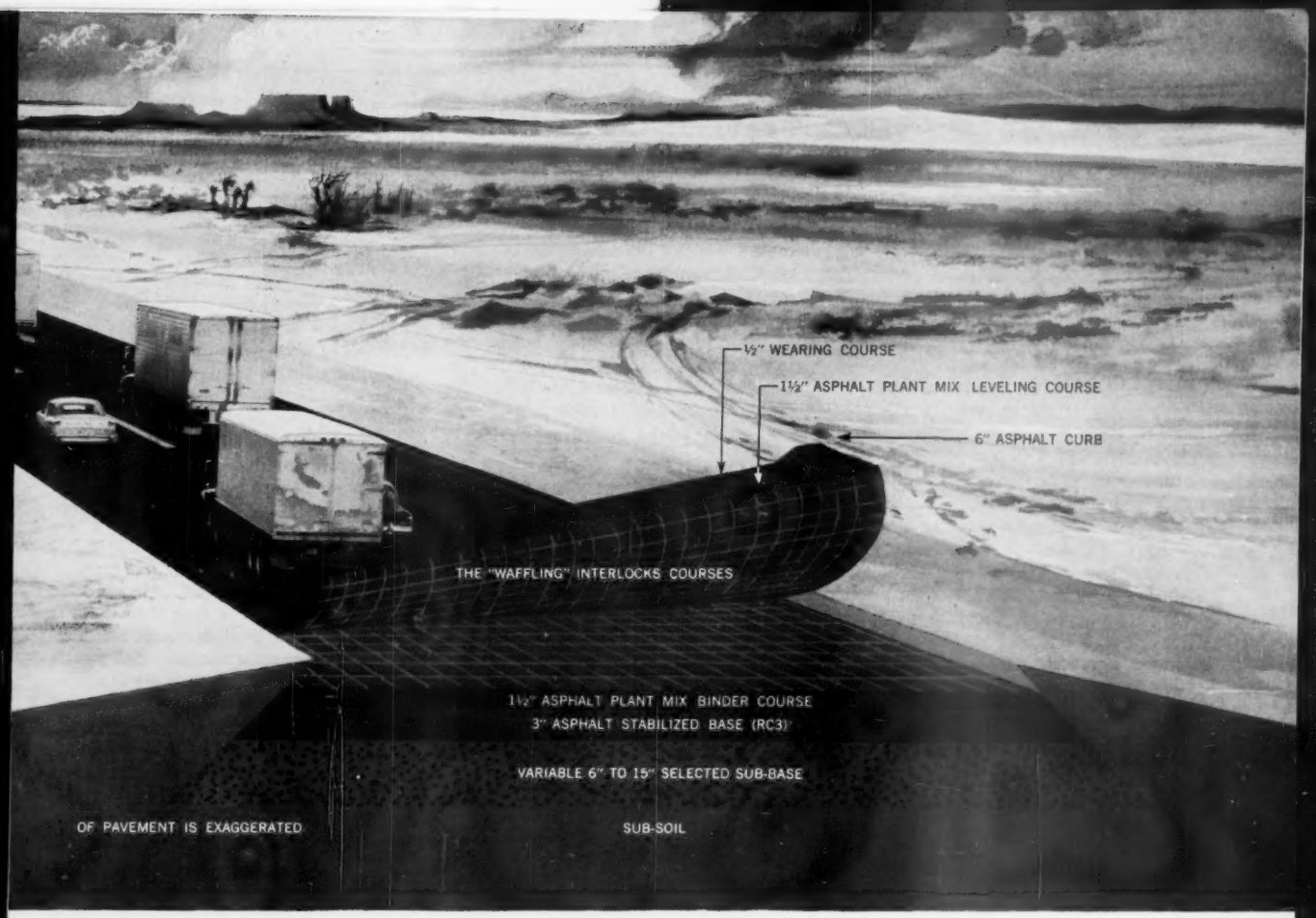
Now, along with the rest of the states, Arizona has launched a vast new road-building program. And even though more federal aid is available than ever before, these roads, too, are turning out to be Asphalt-paved. You don't have to look far for the reasons.

Arizona's veteran Asphalt-paved highways have proved themselves as rugged and durable as they were economical to build and maintain.

U.S. Route 66 between Winslow and Holbrook is an example. First paved more than 25 years ago (with Asphalt and sand!), this pavement is successfully supporting heavy traffic undreamed of when it was first built. "Double" trucks by the dozen barrel over it at 60 MPH. So does the bulk of Arizona's east-west traffic.

Now this veteran main artery, still in the prime of its life, is being given local traffic responsibilities. A new divided Interstate Highway (Route 40), carrying through traffic, will parallel it. The initial section of Arizona's new Interstate 40 is shown above. It is a 5.6 mile stretch between Winslow and Holbrook.

With no aggregate larger than ¾ inch available (and most under ¼ inch), only Asphalt construction could have been used to build this section of pavement up to Interstate standards. Total cost of the pavement structure was $1.75 per square yard!


½" WEARING COURSE
1½" ASPHALT PLANT MIX LEVELING COURSE
6" ASPHALT CURB
THE "WAFFLING" INTERLOCKS COURSES
1½" ASPHALT PLANT MIX BINDER COURSE
3" ASPHALT STABILIZED BASE (RC3)
VARIABLE 6" TO 15" SELECTED SUB-BASE
SUB-SOIL
OF PAVEMENT IS EXAGGERATED

Segment Asphalt-Paved!

pavements leads to decision

The cross section above shows you in detail how low-cost Asphalt materials were used to give this pavement lasting strength despite the scarcity of aggregate.

Notice, first, the use of Asphalt in the 3-inch base. This base, a sandy gravel, was road-mixed on the selected sub-base using RC-3 liquid asphalt.

Notice, second, (see right roadway above) that the 3-inch leveling course was asphalt plant-mix laid down in two courses. A novel between-course inter-lock was provided by "waffling" the lower course while still hot with a 4-inch square grid pattern, impressed about ⅜-inch into the surface. A tack coat was applied and a second course constructed. Then, a ½-inch wearing course was laid to insure a non-skid surface.

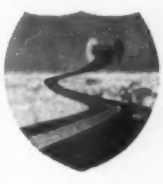
Notice, third, that both base and surface courses are uniform across the whole width of the road, shoulders as well as traffic lanes.

Notice, fourth, the use of Asphalt curb to provide controlled drainage, prevent embankment erosion and aid safety.

BEAT SCHEDULE BY TEN WEEKS

With today's equipment, modern heavy-duty Asphalt concrete pavement is being laid at record, reputation-building, tax-fund-conserving speeds. In this case, construction was completed 10 weeks ahead of schedule . . . in plenty of time to accommodate the bulk of the summer tourist traffic.

Modern Asphalt concrete pavement can help **you** speed your highway modernizing program. It provides, as well, strength, durability and economy in full measure. Specify it for your Interstate Highways. Primary and farm-to-market roads, too.



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Letters to the Editor

Down with Metric . . .

Dear Editor:

I would like to point out a few things which might be considered errors, or at least controversial statements, in the article entitled "Should We Adopt the Metric System?":

Par. 10. Other countries besides the U. S., Britain, and the commonwealth countries still rely on the inch and the ounce. The "zoll," meaning inch, is widely used in Germany. Inches are used universally to measure tires, i.e. 6.00 x 16, and in many un-English countries to measure pipe. Of course, inches must also be used when repairing, buying, borrowing, or accepting as gifts American or British equipment anywhere in the world. The "onza" or ounce is common in Latin countries.

Par. 11. The slide rule and desk calculator are not "metric" in nature. They are "decimal in nature." Even Webster confuses this issue by defining metric as "pertaining to the decimal system of measurement of which the meter is the basis." What Webster should say is "pertaining to *that* system of measurement of which the meter is the basis," since there are obviously other decimal systems than the metric, for example, the decimal system expounded by Leonardo da Pisa in 1202, five hundred years before the metric system was invented.

Pars. 14, 15, 16, 17, 18, 19 are biased to present the case *for* the metric system. The article to be fair should have also included a rebuttal in favor of the English system, which can also be meshed into multiples of 10 and can also become a customary measure in foreign trade, which it is, in spite of the Russians.

Par. 20 is an exercise in logic. We are asked to visualize sending technicians to undeveloped countries, then told that these technical people and technical equipment are undesirable because they are not geared to the indigent undeveloped technical people and equipment. Perhaps the undeveloped countries should be sending their technicians and equipment to us.

Par. 21. Technical training would still include training in conversion of units even if the metric system were adopted. There are over 1500 different units of measure listed in the dictionary, and they will all continue to be used even if only for historical records. For example, many land surveys in Texas are in "varas." Time spent on conversion tables is no more wasted time than time spent translating languages, and time spent on advocating the use of the metric system in the U. S. may turn out to be just as useless as the time spent campaigning for Esperanto or Prohibition.

Par. 25 is an understatement. The change to metric if attempted overnight would not only be costly, it would be pandemonium. I find it difficult to visualize my grocer throwing out all his butter tonight because it is packed in pound packages. Think of the money to be made in bootlegging and black-marketing contraband English-measured goods. The educational problem alone is fantastic. Most of the good carpenters I know are too old to learn metric measure, and most of the young ones are too lazy.

Par. 36 leaves me somewhat let down. I don't see just what was the purpose or point of the article. We have been told that the metric system is good, and that it is in use in every civilized country in the world. Finally we are advised that it should be "adopted" by every country. It already is "adopted," and adopted it will remain, to be used whenever it is economical. If by "adopted" is meant that all other systems of measurement should be prohibited by law, that is ridiculous. If the intent of the article is to convince readers that more of them should use the metric system, fine. Let all readers of the AMERICAN ENGINEER leave a note in the milk bottle tomorrow morning for ½ liter of sour cream. Such a note might even be written in French, the international diplomatic language: "Plus ça change, plus c'est la même chose."

Henning B. Dieter, Jr., P.E.
Austin, Texas

► Editor's Note: In reference to paragraph ten, it is true that there is a scattering of English system measurements in some of the so-called metric system countries just as there is a scattering of metric system use in the U. S. and England. But the basic measurements of all countries except the U. S., England and the commonwealth, are based on the metric system.

Proponents of the metric system would probably argue at length about the comments on paragraph twenty-five. They point to the fact that a number of countries have successfully changed their measuring systems without any "pandemonium." India, a country whose literacy rate is considerably lower than that of the U. S., in just the past year switched from the English system to the metric system with a minimum of confusion.

'Great Interest' . . .

Dear Editor:

I read, with great interest, your article: "Should We Adopt the Metric System?" . . .

Robert S. Mayo, P.E.
Lancaster, Pa.

No Problems with Metric? . . .

Dear Editor:

In my forty odd years of amateur championing of the metric system, I have over and over heard the same objection as that quoted in your article in the September issue (page 25): "Oh, but then you'd have to throw out all your machine tools, equipment, drills, taps, dies, etc., and buy new ones!"

Not at all. A ¼" drill would con-

(Continued on page 6)

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American Engineer

NOVEMBER 1959
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LETTERS

(Continued from page 4)

tinue to be used, its name would simply be changed to "6 mm." Gradually as time passed, drills would be made which were exactly 6 mm in diameter but there would be plenty of time to wear out all the ¼" drills in stock.

The same would hold true for all other tools, jigs and what not. The only things that would have to be thrown out and replaced would be devices for measuring in the English system: rules, micrometers, weights and the like.

William F. Saunders, P.E.
St. Louis, Mo.

Change to Metric Now . . .

Dear Editor:

Two serious arguments are listed against the adoption of the metric system in the September, 1959, issue of the AMERICAN ENGINEER:

1. Machine tool equipment and text books will have to be replaced with such of metric measurements.

2. It might take a long time for the average American to become accustomed to the metric system.

The other countries of the world were faced with exactly the same difficulties when they decided to adopt the metric system instead of their old systems which were quite similar to the English system around the turn of the 19th . . . century, and it is only deplorable that we missed our chances in 1902.

The real difficulty in machine tools was only in screw threads. This was not changed and screw threads are specified in inches nearly everywhere in the world, which is a good example of how the two systems can exist together.

The American public certainly will get accustomed to the metric system just as fast if not faster than other people in the world, especially when it will see the great simplicity of the metric system in practice.

"The great debate" about the metric system reminds me of the great debate about the adoption of the right hand drive instead of the left hand drive in certain countries of Central Europe. That debate went on for many decades and the opponents of the change stated that such a change was impossible because all railway and street car switches and the whole signaling system would have to be changed, and the same would have to be done with highway signals. However, those countries changed over to right hand drive, literally overnight, due to military necessity during the war and without the slightest confusion.

We should debate less and do more for the adoption of the metric system.

Dr. Andrew A. Halacsy, P.E.
Newark, N. J.

Slips . . .

Dear Editor:

In the middle column, page 26, fifth line from the top of page, the word centimeters should be millimeters, or leave the centimeters and change 25.4 to 2.54.

Joseph Gizows, P.E.
Denville, N. J.

► **Editor's Note: Sorry, the decimal point slipped.**

Science and Engineering . . .

Dear Editor:

I read with interest Paul Robbins' "Thoughts on Professionalism," entitled "Engineering as a Part of Science," in the September issue.

. . . I have long been interested in this problem of a distinction between science and engineering. Enoch Needles (of Engineers Joint Council), in his testimony before the Committee on Government Operations of the United States Senate, also emphasized the need for a distinction and wished to emphasize particularly that the term "technology" was not adequate as a proper word to include engineering. . . . As I wrote to Enoch Needles in support of his testimony:

"I also feel very strongly about the need to draw a distinction between science and engineering. We should develop the idea that they are complementary functions, and one is not a subdivision of the other. I am not even willing to accept the common statement that 'science provides us the basic knowledge' because there are basic ideas developed in engineering as such. Furthermore, engineering had a long and proud history of accomplishments before science emerged as a generally recognized branch of human learning. It is true that more and more our engineering is well founded on principles discovered by scientists. Engineers always prefer to understand fully the nature of matter and energy, but we still only 'see as through a glass darkly' why steel and concrete behave as they do and yet we, of necessity, use them extensively. We do not like empiricism, but we do not avoid using materials at our disposal, even though we have to get the information by testing rather than more complete understanding.

"It is easier to distinguish between the 'scientific function' and the 'engineering function' than to distinguish between the man who should be called a scientist and he who should be termed engineer. Many men perform both functions, and do it very well. Although I hold a Ph.D. in physics, I have always considered myself an engineer, never a scientist.

"To my mind the fundamental distinction is as follows:

"The scientific function is the determination of what follows from a given combination of materials and forces.

"The engineering function is the determination of what combination of materials, force, and human factors will produce, with a reasonable degree of approximation, a certain desired result.

"In other words, science is analysis; engineering is synthesis. The fundamental knowledge required to implement these functions is intertwined but originates in both groups, and neither is completely dominating in this respect."

I think these fundamental distinctions should be emphasized by engineering groups, but most particularly by EJC, NSPE, and ECPD. ECPD has chosen not to try to exert major influence on legislation but rather to confine itself to educational problems, but we still need, as part of our program of recognition for the engineer, to disabuse the public of the popular conception that has grown up in recent years that engineering is primarily the handmaiden of science.

W. L. Everitt, President,
Engineers' Council for Professional Development,
Urbana, Ill.

AE Meetings of Note

Atomic Industrial Forum—Annual Meeting, November 2-4, Shoreham Hotel, Washington, D.C.

Society of Naval Architects and Marine Engineers—Annual Meeting, November 11-14, Waldorf - Astoria Hotel, New York, New York.

American Rocket Society—Annual Meeting, November 16-20, Sheraton-Park Hotel, Washington, D.C.

American Society of Mechanical Engineers—Annual Meeting, November 29-December 4, Chalfonte-Haddon Hall, Atlantic City, New Jersey.

Christian, P. E., Vice Pres., Netherwood Avenue, Box 215, Rd. 24, New Brunswick, N. J. • Clark A. Dunn, P. E., Past Pres., Oklahoma State University, Stillwater, Okla. • Russell B. Allen, P. E., Treas., 4610 Hartwick Road, College Park, Md. • Paul H. Robbins, P. E., Ex. Dir., 2029 K Street, N. W., Washington 6, D. C.

"This Month"

We've heard plenty about Russian education since Sputnik, particularly as compared to what we teach in America. But there has been little definitive writing as to just what the Soviets do include in their curricula. We think you will find "What the Russians Teach Their Engineers" (page 19) refreshingly new and provocative.

America grows and grows and this "explosion" presents great new problems for P.E.'s. Certainly the planning of our metropolitan areas means heavy responsibility for the profession. See page 24 for a most interesting article entitled, "The Engineer and City Planning."

And moving far toward the back of the book for a moment (page 49), we find an excellent analysis on "The New Labor Law—What It Means to the Profession." This is worth careful study and filing for future reference.

Back again to page 29 and our Special 16-Page Section with six excellent papers dealing with the fields of "Industry-Education," and the "Merging Role of Engineering and Science." What better way to spend a coolish fall evening than to catch up with the American Engineer?

A look at AE headlines for "This Month:"

General. Page 8. The ever-popular National Engineers' Week is off and away with a most impressive list of sponsors including Wernher von Braun and T. Keith Glennan. In other stories: The AIEE presented medals to Dr. Herbert B. Brooks of Washington, D. C.; William A. Del Mar, Yonkers, N. Y., and Dr. Gordon S. Brown, Cambridge, Mass.

Consulting. Page 10. The Big Story: Baltimore Firm Held Under Wage-Hour Act. (The firm of Singstad & Baillie, designers of the new Baltimore Harbor Tunnel, is the organization involved.)

Education. Page 14. A recent tax court ruling would liberalize income tax deductions for advanced education. In another story, the unique report of how a freshman at the Missouri School of Mines became a second semester freshman after only seven days on the campus! It's true.

Industry. Page 16. NSPE announces an important new industrial professional development award to the industrial employer of engineering personnel which has made an outstanding contribution to professionalism in industry. And in another story, a new survey by the Opinion Research Corporation reveals that seventy-two per cent of the 622 engineers and scientists interviewed feel that management misuses their talents.

In the back of the book, page 52. A most comprehensive staff report on the recent meeting of the NSPE Board of Directors in Pittsburgh. The highlights: The Vermont SPE becomes the 51st NSPE affiliate...NSPE gains its first student chapter through the U. of Pittsburgh...presentation of 1960 budget and programs...student chapter debate ...the Society plans broad survey of personnel policies of government at all levels.

Kenneth E. Trombley

Editor

General News

Sponsors Announced for '60 National Engineers' Week

- Prominent Engineering Figures Listed
- Von Braun, Glennan in 13-Man Group

Thirteen leading engineering figures will act as sponsors for the 1960 National Engineers' Week.

They are: Wernher von Braun, director, Development Operations Division, Army Ballistic Missile Agency; Allen B. DuMont, chairman of the board, Allen B. DuMont Laboratories, Inc.; T. Keith Glennan, president-on-leave, Case Institute of Technology, and administrator, National Aeronautics & Space Administration; James R. Killian, Jr., chairman of the Corporation, Massachusetts Institute of Technology; Clarence H. Linder, vice president, General Electric Company; Granville M. Read, chief engineer, E. I. du Pont de Nemours and Company;

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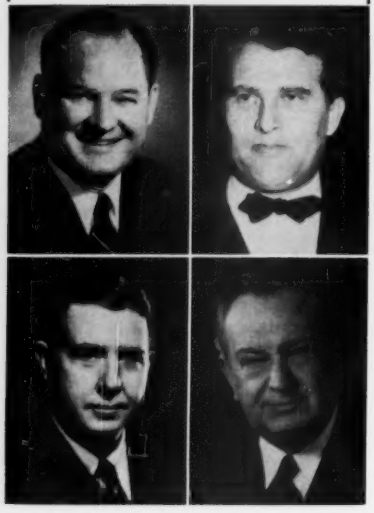

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AIEE Presents Medals To Leading Engineers

The American Institute of Electrical Engineers has presented three medals to leading engineers for professional achievements.

Two of the medals, the Morris E. Leeds Award which was presented to Dr. Herbert B. Brooks, of Washington, D. C., and the William M. Habirshaw Award, which went to William A. Del Mar, Yonkers, N.Y., were presented for the first time. The third award, the AIEE Medal in Electrical Engineering Education, was presented to Dr. Gordon S. Brown, dean of engineering Massachusetts Institute of Technology, Cambridge. Each award consisted of a medal, a certificate and $500.

We Are Not Alone

According to the American Bar Association's Committee on Unauthorized Practice, there are some 30,000 Federal employees doing legal work, but only 7,500 of them are lawyers. The ABA Committee is trying to correct the situation by working out improved definitions of legal work with the Civil Service Commission.

In another related area of interest, the Committee on Lawyers in the Armed Forces is preparing a package program for legislation designed to give lawyers in the Army, Navy and Air Force professional recognition.

Case Institute Starts New Research Project

How much time do scientists spend in reading? Are there cheaper ways of publishing technical information? These are two of the questions for which answers will be sought in a new research project at Case Institute of Technology.

The National Science Foundation has provided a grant of $40,000 to Dr. Russell L. Ackoff, professor of Operations Research at Case for support of two studies.

One is entitled "An Operations Research Study of the Scientific Reading Practices of Chemists and Physicists" and the other "An Analysis of Economics of Publications of Leading Chemical Journals." The grant will support the studies for a period of one year.

The grant is the outcome of a series of studies conducted by Professor Ackoff and his associates, on the way chemists spend their time. In these studies it was found that chemists spent an average of 16½ hours a week in scientific communications, and 6.7 hours per week in business communication. This was larger than the approximate sixteen hours per week spent in working with scientific equipment.

Nuclear Power Growing Rapidly Says Leggett

A leading American engineering executive says that nuclear power is being developed twice as fast as any previously known source of heat and power.

Rear Admiral Wilson D. Leggett, Jr. (USN-Ret.), vice president of engineering for ALCO Products, Inc., pointed out in a speech recently that nuclear power "has found a place in submarines in less than one-tenth of a century . . . and has also made a significant start in commercial applications."

The former chief of the Navy's Bureau of Ships declared that "if nuclear power becomes a real factor commercially by 1970, it will have moved at twice the pace of any previous fuel and faster than any previous machinery development. It seems pretty generally agreed that this can be done."

Leggett made the remarks in a speech prepared for delivery at a meeting of the Engineering Society of Detroit at the Horace Rackham Educational Memorial.

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Baltimore Firm Held Under Wage-Hour

- **Harbor Tunnel Designers Involved**
- **Federal District Court Rules**

The consulting engineering firm of Singstad & Baillie, designer of the new Baltimore Harbor Tunnel, was recently held subject to the provisions of the Wage-Hour Act by a Federal District Court in Baltimore. The action was brought by the Secretary of Labor to enjoin the firm from violating the overtime and record-keeping provisions of the Act.

In holding for the Department of Labor, the court cited the Supreme Court decision in the key test case against Lublin, McGaughy & Associates, which ruled that the activities of nonprofessional employees of a consulting engineering and architectural firm are within the coverage of the law, even though the firm's activities are of a professional nature.

Singstad & Baillie was engaged by the Maryland State Roads Commission to design, prepare the plans and specifications for, and supervise the construction of the tunnel proper, the adjacent ramps, the service building and two emergency garages near the tunnel entrances. Although the over-all length of the project was 15.2 miles, Singstad & Baillie's contractual obligations and authority were limited to the 1.7 miles from grade point to grade point.

J. E. Greiner and Company was named as "consulting engineer" for the entire project, and acted as liaison between the Commission and Singstad & Baillie. The contract with Singstad & Baillie designated it as the direct representative of the Commission, subject to coordination and direction by the consulting engineer.

The contract with the Commission was unique insofar as Singstad & Baillie was concerned because they had never before agreed to supervise the construction of a tunnel; their services being limited to design work and the preparation of plans and specifications. On the Baltimore Harbor Tunnel, however, the firm employed inspectors, field clerks, rodmen, chainmen, and others who performed nonprofessional work at the job site.

Singstad & Baillie offered several defenses to the Secretary of Labor's accusations: 1) the work was excluded from the Act under the "new construction" rule; 2) the firm was exempt as an agent of the State, and 3) the issue was moot since the work had been completed and the firm did not employ more than one nonprofessional employee in its New York headquarters office.

On the "new construction" issue, the court declared that this concept "received a severe if not a fatal blow" from the U. S. Supreme Court in *Mitchell* v. *Vollmer & Co.* in which it was said that "the question whether an employee is engaged in commerce within the meaning of the present Act is determined by practical considerations, not by technical conceptions." Previous to the *Vollmer* case, it had been held that employees engaged in the original construction of roads, bridges, etc., were engaged in a local activity and were not engaged "in commerce," even though the roads and bridges were to be integrated later into an interstate highway system.

"The tunnel project," the court continued, "was intended to serve as an important, definite addition to or improvement of existing identifiable instrumentalities (the highways through Baltimore City) and thus facilitate the flow of commerce by savings in time and distance, by the elimination of costly delays and bottlenecks, and by a variety of other means.

"Defendants argue that the tunnel, 1.7 miles from grade point to grade point, should be considered by itself, apart from the approaches or the project as a whole. This contention is without merit. If the declared purpose of the Act is to be accomplished, a project should be considered as a whole, in a realistic way, not broken down into its various phases so as to defeat the purpose of the Act."

On the second point of defense, Singstad & Baillie argued that they were acting for and on behalf of the Commission as an agent, not as an independent contractor, and consequently were excluded from the Act under language which exempts from the definition of "employer," the "United States or any state or political subdivision of a state."

The firm's contention that it stood in the same position as the Commission, however, "is not supported either by fact or law," the court ruled. "Singstad & Baillie were independent contractors, who acted on behalf of the Commission as its agent for certain purposes, namely, the design of the tunnel, the preparation of plans and specifications, and the supervision of construction. Singstad & Baillie were not agents of the Commission for the purpose of hiring employees of the Commission. The inspectors, field clerks, linemen, and others were the servants (employees) of Singstad & Baillie. They were hired, fired, controlled and directed by Singstad & Baillie for purposes of the workmen's compensation law and the unemployment security law. Neither Singstad and Baillie nor their employees became servants of the Commission."

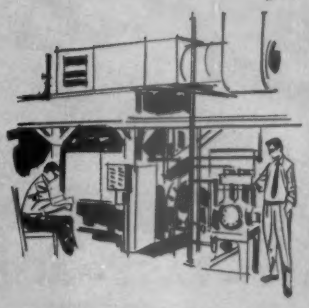
The court also stated in a footnote at this point that "nothing said herein is intended to imply that

(Continued on Page 12)

2 Special Inserts in This Issue . . .

On page 29 ➡

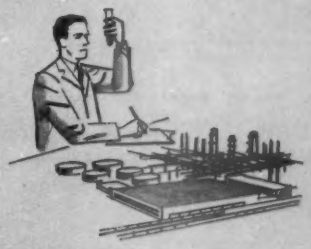
Industry-Education . . .



Three excellent papers of interest to both engineers in industry as well as in education are contained in this month's issue. Presented at the National Society's Silver Anniversary meeting in New York this summer, these papers are "must" reading. The titles and authors are: "Realizing the Highest Potential of Engineers in Industry Through Advanced Education," by Dr. Warren C. Stoker, director, Hartford Graduate Center, Rensselaer Polytechnic Institute; "The Role of Technicians in Conserving Engineering Brainpower," by A. C. Friel, P.E., chairman, NSPE Committee on Engineering Technicians, and "Lessons of the Engineering Utilization Conferences," by Dr. William Torpey, Office of Civil and Defense Mobilization, Washington, D.C.

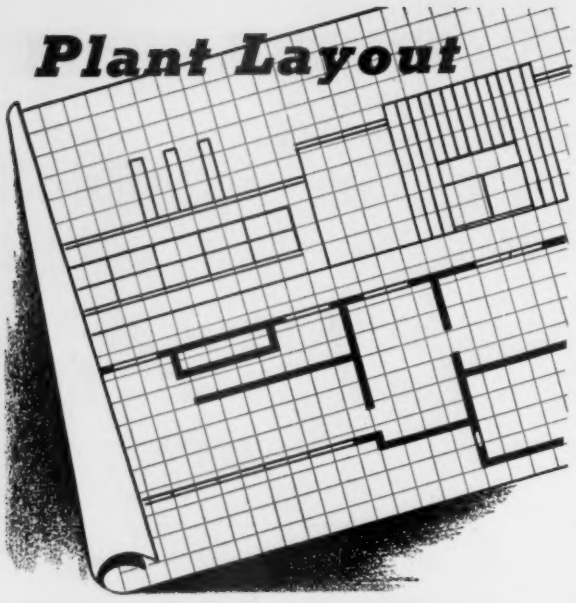
On page 39 ➡

The Merging Role of Science and Engineering . . .



It has become apparent in recent years that there has been an increasing amount of teamwork among engineers and scientists. This growing relationship was the topic of a panel discussion during the New York meeting. Participants and their topics are: "The Merging Role of Engineering and Science," by James F. Fairman, P.E. (moderator), senior vice president, Consolidated Edison Company of New York, Inc.; "The Merging Role of Engineering and Science in Industry," by Clarence H. Linder, P.E., vice president, General Electric Company, and "The Merging Role of Engineering and Science in Education," by John C. Calhoun, Jr., P.E., vice president for engineering, Texas A&M College.

Keep Ahead . . . Read the *Every Month*



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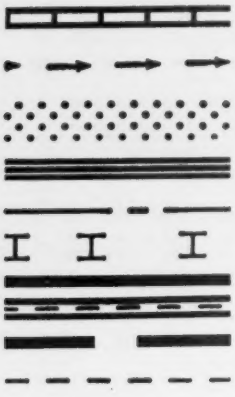

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(Circle 2 in Readers' Service Dept.)

BALTIMORE FIRM

(Continued from page 10)

Greiner became the alter ego of the Commission or was exempt from the provisions of the Act."

As for the argument of mootness, the court noted that Singstad & Baillie continued to employ a few nonprofessional employees in Maryland at the tunnel site after the instant suit was filed, and that they still employ some designers and draftsmen who may be nonprofessionals in their New York office.

The court made a special point of commenting on the firm's statement that only the secretary in its New York office is a nonprofessional and therefore covered by the Act. The firm contended that most routine drafting is done by graduate engineers, many of them with European degrees, who are not qualified to practice as engineers in the United States.

"It is hard to believe," the court said, "that a firm as large as Singstad & Baillie can operate with only one nonprofessional employee, a secretary. However many degrees a person may have, if he does routine work under supervision or other work which does not qualify as professional work under the test provided by the statute, he is a nonprofessional employee." (*Mitchell* v. *Singstad & Baillie,* Civil No. 10050, Sept. 28, 1959).

Although the court granted the injunction sought by the Secretary of Labor, its operation was suspended because of the firm's good faith, its promise to pay past claims of all nonexempt employees and its promise in the future to keep records required by the Act and to pay nonexempt employees in accordance with the provisions of the Act. The court also noted that the position of Singstad & Baillie was supported by the Attorney General of Maryland.

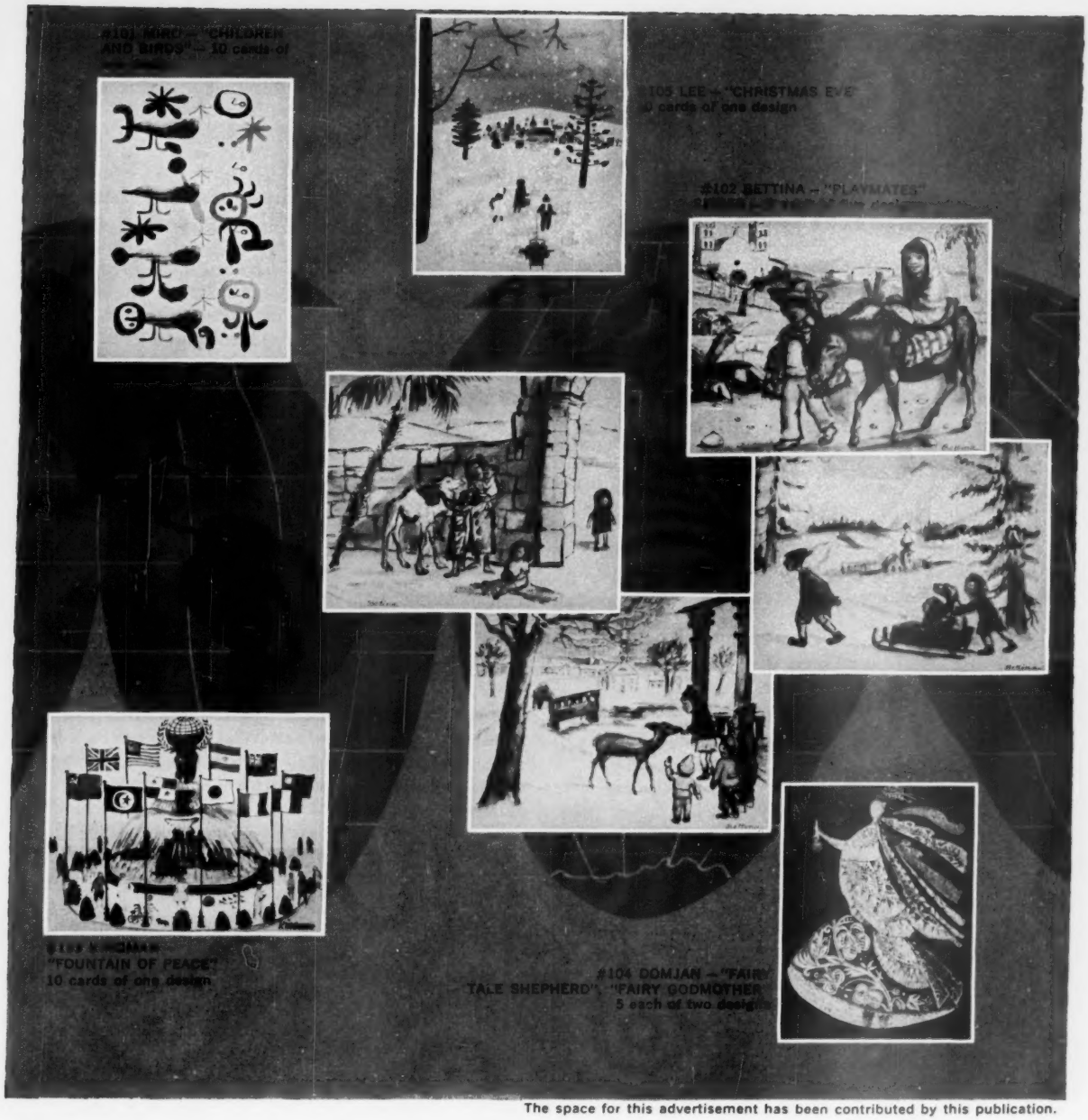
Announce Education Grants At Consultants Meeting

"In the last two decades, a revolution has been underway in the practice of engineering," Henry T. Heald, president of The Ford Foundation, told the recent annual meeting of the American Institute of Consulting Engineers. "Yet engineering education—the gateway to professional practice—has lagged behind," he said.

Mr. Heald announced the first major Foundation grants in its new program in science and engineering at the meeting in Washington. They total $19,050,000 and will go to ten institutions in the United States.

"In a hopeless race against time and reality, most engineering students in their late teens and early twenties are being equipped for the engineering of the last half of the twentieth century by being indoctrinated with the art and practice of the 1950's," he stated.

He urged that engineering education impart "a thorough understanding of science and mathematics, their frontiers, and how they may be applied to the needs of mankind."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The space for this advertisement has been contributed by this publication.

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Court Ruling Suggests Broad Interpretation on Deduction

A recent decision of the U. S. Tax Court, involving the claim of a physician for a deduction for educational expenses, has indicated that the Court will broadly interpret the 1958 educational expense Regulations, at least as far as not requiring the taxpayer to show that it is customary for one in his field of endeavor to undertake such education.

Briefly, the 1958 Regulations state that the deduction will be allowed if taxpayer's "primary purpose" is to maintain and improve skills required by the taxpayer in his employment, or other trade or business. It is explained that this test is met if it is customary for members of taxpayer's trade or business to take such courses. On the basis of its recent decision, however, the Tax Court has taken the position that it is not necessary for the taxpayer to show that others in the field take the course, but merely that he took the course to improve his skills.

The Court's ruling involved a case in which a physician specializing in internal medicine undertook extensive training in the techniques of phychiatry in order to enable him to do a more thorough job in his practice of internal medicine. The Commissioner of Internal Revenue disallowed the deduction on the theory that the physician did not prove it was customary for similar practitioners to take such courses. The Tax Court disagreed, saying that the test under the Regulations was one of "primary purpose" and here the primary purpose was to improve his skill in his field, and not to fit the taxpayer for practice in the specialty. The fact that he could not show the custom would not in itself be enough to deny the deduction.

Under the test set up by the Tax Court, where a taxpayer takes a course, it is not necessary for him to show that others in the field take the course, but merely that he took the course to improve his skills. Of course, if the taxpayer could show that others in his field did take the course, he would have an easier time justifying the deduction under the present Regulations.

It must be remembered that the Regulations will not allow an educational expense deduction if the expenditures are made primarily for the purpose of obtaining a new position or substantial advancement in position. An engineer studying law, for example, would not be allowed to deduct such expenses.

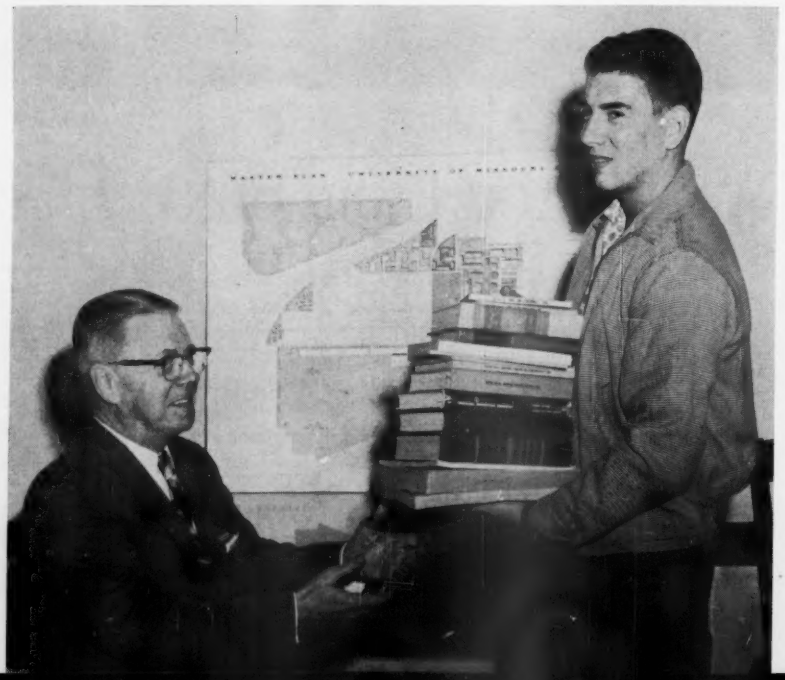
Missouri Student Sets Academic Speed Record

A new record for academic speed was set recently at the Missouri School of Mines by Don E. Burton, 18-year-old freshman from Kansas City, Mo., who had the right to call himself a second semester freshman after only seven days on the campus.

This remarkable record is the result of a relatively new program at the Rolla school in which qualified freshmen may gain credit for required freshmen courses by passing examinations offered in those courses. Burton chalked up a total of twenty-one semester hours, which amounts to approximately fourteen per cent of the hours required for graduation. In addition to the first semester courses in which Burton received credit, he is four hours ahead on his second semester requirements.

Under the program, which has been in effect for all freshman courses for the past two years, other students have acquired credit for as many as three courses, or thirteen hours, but Burton is the first stu-

Donald E. Burton, freshman at the Missouri School of Mines, hands over all first semester books to Dean Curtis L. Wilson. (See story at right above.)



dent to make a clean sweep of all subjects offered.

Courses in which Burton has acquired credit in his first week of school are as follows: first semester mathematics, five hours; first semester chemistry, five hours; engineering drawing, two hours; descriptive geometry, two hours; English, three hours and military science, four hours. Burton made A's in twelve hours, B's in nine hours of the courses he hadn't yet taken.

Burton, who is the recipient of the General Motors Scholarship at the School of Mines, also received the Phi Beta Kappa scholastic award and the Curator's award. He passed up a principal's appointment to West Point and an Air Force Academy nomination in favor of nuclear studies at the School of Mines.

The salutatorian in his 1959 graduating class at Southeast High School in Kansas City, Burton took a "solid" high school course, including four years mathematics, four years English, four years social studies, four years ROTC, four years drawing, two years science and two years language.

Standards Raised at AEC School in Illinois

John A. McCone, chairman, U. S. Atomic Energy Commission, has announced that the curriculum at the International School of Nuclear Science and Engineering will be raised to a higher professional level and the program broadened to meet the growing needs for highly advanced and specialized training of scientists and engineers in the nuclear field.

The name of the school, located at the Commission's Argonne National Laboratory, Lemont, Illinois, will be changed to the International Institute of Nuclear Science and Engineering. All changes are effective on January 1, 1960.

The Institute's curriculum will be at the postgraduate level. The facilities of the International School for training in the design, instrumentation and use of nuclear research and power reactors will be expanded to meet the requirements of the Institute.

MEMO

To:
ENGINEERS IN PRIVATE PRACTICE
ENGINEERS IN GOVERNMENT PRACTICE

Subject:
YOUR OPPORTUNITY TO PARTICIPATE IN A FUNCTIONAL SECTION

To better serve the special interests of engineers in various phases of professional activity, the NSPE Board of Directors has authorized the establishment of functional sections within the framework and with the support of the National Society.

This development gives us a chance to further advance our interests through our own additional efforts and participation. Already many programs and special activities have been undertaken to serve these interests. More ambitious plans are in the making.

To achieve maximum benefit from the functional section, the direct and individual participation of every interested member is needed. Each participant, by making his interest known through the use of the coupon below, will place himself in a position to make the greatest contribution to the work of the functional section and to receive special bulletins and other material of interest to him.

Wesley E. Gilbertson, P. E.
Chairman Functional Section for Engineers in Government Practice

Alfred H. Samborn, P. E.
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New Industrial Professional Development Award Set

- First Presentation Planned for 1960
- Mosher Reveals Details of Program

An Industrial Professional Development Award will be presented annually by the National Society of Professional Engineers to the industrial employer of engineering personnel which has made an outstanding contribution to the advancement and improvement of the engineering profession through its employment practices.

The first award will be presented by the NSPE president at the annual meeting in June, 1960, in Boston.

The twofold purpose of the award is to "give adequate recognition to the firm which has demonstrated the application of forward-looking engineering employment practices, and to encourage industrial employers of engineering personnel to adopt progressive engineering employment practices in accord with established professional standards," Harold A. Mosher, NSPE president, stated in announcing the award.

Mr. Mosher said the award was "a part of the continuing NSPE program to aid in the enlarging of opportunities for professional growth among engineers employed in industry." The National Society president added that one of the important factors in the annual award will be the "widespread dissemination of information about some of the excellent professional development programs now available to engineers in industry."

Nominations for the award will be submitted by local chapters of the National Society. The NSPE Industrial Award Committee will make the final selection from nominations submitted by state societies affiliated with the National Society.

Five professional engineers in industry have been named to serve on the Award Committee. They are: Robert A. Blackburn, manager, strategic materials section, engineering and construction division, Koppers Company, Inc., chairman; Louis J. Larson, consulting engineer, Welding Industries Group, Allis-Chalmers Manufacturing Company; Wayne E. Ault, manager, technical department, "Automatic" Sprinkler Corporation of America; George Steven, general manager, Worthington Corporation, and R. F. Danner, vice president, research & development, Oklahoma Gas and Electric Company.

Among the engineering employment practices which will be considered for the award, according to Chairman Blackburn, are those relating to registration, education and technical training, technical and professional society membership, engineers as authors, professional working conditions, utilization, engineering titles, and engineer-management communications.

Further information about the NSPE Industrial Professional Development Award may be obtained from the National Society headquarters.

Industrial Award

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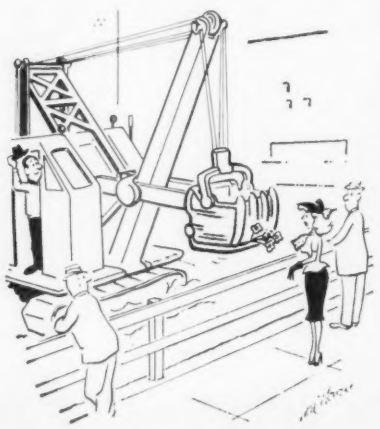
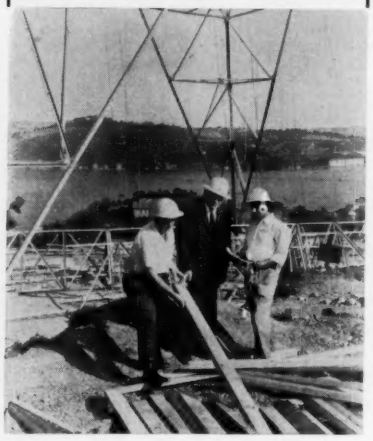


Construction in Turkey



W. L. Sheets (center), vice president and construction manager of Stone & Webster Engineering Corporation, is seen in Turkey on the European shore of the Bosporus, where the first aerial power transmission line to connect Europe and Asia is being built. The project is scheduled to be completed in February, 1960. At left is R. P. Eakins, resident superintendent for Stone & Webster. At right is Niyazi Yildirim, superintendent for Etibank, the biggest Turkish Government-empowered development bank founded to finance the electrification of Turkey.

Labor Bureau Expands Industry Salary Survey

The Bureau of Labor Statistics, Department of Labor, is expanding its community wage surveys of white collar pay in private industry. Eighty metropolitan areas will be covered, with professional and managerial pay being reported nationwide. The first report is due in December, 1960.

The purpose of the study is to secure comparative information for related Federal Government grades. The survey will cover twenty-eight occupations, including engineering, physical sciences, mathematics, accounting, legal and others. It is planned to cover 2,100 establishments from manufacturing, transportation, communication, public utilities, trade finance and insurance, and engineering and architectural services. Of special importance to engineers, the study will cover pay distinctions among engineers in private enterprise.

Misuse of Talent Claimed

Engineers and Scientists claim that management misuses their talent, according to a recent survey by Opinion Research Corporation.

Of the 622 engineers and scientists interviewed from six major corporations, 72 per cent complained that management misuses their talent; 80 per cent thought they were underpaid compared with other groups; 75 per cent wanted to escape the corporate pressures and "work their own way," and 67 per cent said that "pull," rather than knowledge, is the key to getting ahead in management.

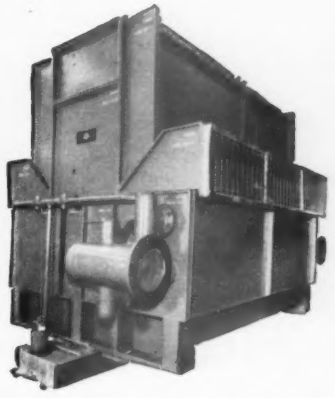
In their report, Opinion Research observes that, while managers tend to derive satisfaction by being associated with a successful company, engineers and scientists want recognition directly related to their individual contributions. The 105 managers surveyed at the same time agreed that the scientific mind needs a different order of recognition from the management mind but "little has been done to fill this need," the report states.

When asked to name those "well thought of" in the community, fifty-six per cent of the engineers and scientists named management, while only nine per cent listed themselves in that class.

The survey found that eighty-two per cent of the engineers and scientists said they were "mainly responsible" on sciences' contribution to the country's rising standard of living—seventy-nine per cent of the managers agreed.

The engineers and scientists revealed that is why they feel they deserve more credit in both recognition and pay.

ECONOMICAL COOLING OF GASES AND COMPRESSED AIR



Cooling gases or cooling and removing moisture from compressed air, the Niagara *Aero* After Cooler offers the most economical and trustworthy method. Cooling by evaporation in a closed system, it brings the gas or compressed air to a point below the ambient temperature, effectively preventing further condensation of moisture in the air lines. It is a self-contained system, independent of any large cooling water supply, solving the problems of water supply and disposal.

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(Circle 6 in Readers' Service Dept.)

Youth holds the key to the future of engineering in both Russia and the U. S. Above, a young Russian student works in a machine shop; below, a future American engineer looks over a chemical company's display.

What the Russians Teach Their Engineers

ENGINEERING education today finds itself becoming more and more of an issue in the cold-war competition between the U. S. and Russia.

The growing importance of education—and most particularly engineering education—was made dramatically clear during Premier Khrushchev's trek across the U. S. in September. Before microphones, crowds and television cameras, the Soviet boss time and again emphasized and boasted about his country's rapid advances in education.

And most of the time it was the education of Russian engineers that Khrushchev and his aides seemed particularly anxious to expound upon. Once during a major address before the National Press Club in Washington, D. C., the Russian leader took time out to have his education minister announce that the Soviets had graduated 106,000 engineers in the last year. That, Khrushchev proudly told the American newspapermen, was "three times as many as you graduated." Later in New York and again in his farewell address in Washington, Khrushchev saw fit to re-emphasize Soviet achievements in education, each time pressing hard on the engineering aspects of the program.

Khrushchev's obvious high regard for Russian engineering education was no mere boast intended solely for the consumption of the American public. For, in Russia today, the engineer and the institutions which produce him are held in the highest esteem by the entire Communist society.

This aspect of the Communist culture has interested and impressed American observers who have

viewed the Soviet educational system firsthand. One of these groups was an eight-man education exchange mission from the American Society for Engineering Education. Here's what they reported after returning from Russia last year:

"Nowhere are the engineer and scientist held in higher regard than in the USSR: they are among the aristocracy of Soviet society. Engineering students and practicing engineers are exempt from military service. An engineering education opens the door to positions of high rank. On the other hand, to achieve such positions without some type of diploma would appear virtually impossible. In general the limit of achievement of the non-graduate in the future in an industrial enterprise is the position of foreman, while this is considered to be the starting position for a graduate. There is, therefore, strong motivation and social pressure to aspire to a career in engineering."

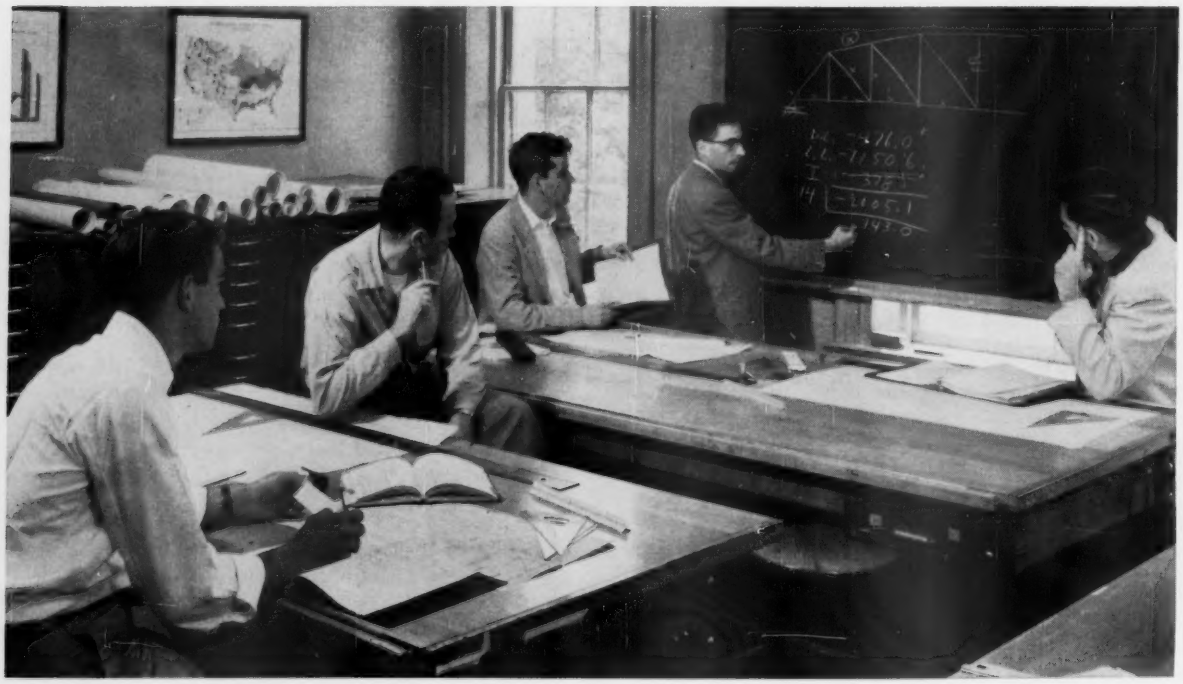
The U. S. Office of Education in its recently published bulletin *Soviet Commitment to Education* comes up with similar evidence, but on a broader scale:

". . . In the organization of a planned society in the Soviet Union, education is regarded as one of the chief resources and techniques for achieving social, economic, cultural and scientific objectives in the national interest. Tremendous responsibilities are therefore placed on Soviet schools, and comprehensive support is provided for them by all segments and agencies of Soviet society."

The Soviet popularization of education—and more specifically engineering and scientific education—is apparently paying big dividends today in producing a bumper crop of professional people to fill the needs of a rapidly growing economy. With a diploma being the principal means for economic and social status, competition is keen for entrance to the top institutions of higher learning, a factor which the Russians are convinced is channeling its top brainpower into engineering and scientific endeavors.

In its report, the ASEE mission estimated that an average of only about one in four who seek entrance actually gain admission to engineering institutions. Admission depends largely on grades scored on entrance examinations covering physics, chemistry, mathematics, one foreign language and Russian. In evaluating these examinations, the ASEE group reported that the preparation of Soviet students in mathematics and chemistry "appears to be comparable in level, but somewhat broader in coverage than that of the applicants to leading U. S. engineering schools." In physics, the ASEE said, the average Soviet students appear to be "appreciably better prepared than our best."

All of these rigid entrance requirements, high competition and the prestige attributed to higher education apparently accounts in a large part for the serious air which pervades the engineering institutions. Failure rates are low, averaging less than fifteen per cent nation-wide. Some institutions, like



Civil engineering students in an American university work out a theoretical problem on the blackboard. Russian engineering students are being required to put in more actual work experience before being graduated from Soviet engineering institutes.

the Leningrad Polytechnic Institute, claim that more than ninety per cent of the students admitted successfully complete a basic engineering course.

"Under a system that attaches so much importance to the diploma and one in which competition for admission to an institution of higher learning is so severe, it was not surprising to find an attitude of grim determination among the students," the ASEE mission reported. "One sensed that they had a high regard for scholarly achievement and a disdain for the laggard."

Once the student is admitted to one of the institutions, known as VTUZ's, he is caught up in a severe program of specialization which dominates the Russian engineering education. The student is free to apply for any one of the specialities in which there is an opening, but once accepted he usually must remain in that field. His job placement after completion of the schooling, likewise, is generally limited to the speciality in which he received his training. Many of the VTUZ are so specialized that only one field of engineering is taught. So, if a student desires to be a mining engineer, he must attend a mining institute; or if he desires to be an aviation engineer then he must apply to an aviation institute.

With six class days a week in a nine and one-half month school year, the basic engineering course is completed in the VTUZ in five years. A few special schools have now extended their courses to a five and one-half year program.

In its survey of Russian curricula, the ASEE found that the first two years in most of the VTUZ's were devoted to a common core of basic sciences such as mathematics, physics, chemistry and mechanics, basic skills of draft ing and machine shop along with nontechnical materials of foreign language, economics and the study of Leninism and Marxism. The third and part of the fourth year are concerned largely with applied sciences of thermodynamics, metallurgy, electrical science and similar subjects, as well as introduction to design and a further study of social disciplines. The fourth and fifth years are centered around the specialty of the student. The entire last semester is devoted to a "diploma project" based on some phase of the speciality.

Here is the ASEE mission's description of the diploma project:

"The diploma project is an individual design of a piece of hardware, a study of an industrial process, or for a few top students a piece of research. Typical diploma projects might be the design of a gas turbine propelled locomotive, the design of a dam and a hydroelectric power station at a specified location, the automation of the production process of a television tube. The subject for this project

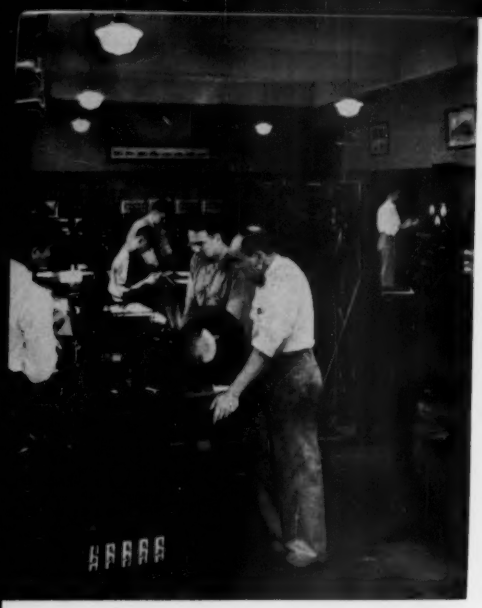
Rickover's Views . . .

This is what Admiral Hyman G. Rickover had to say about U.S. and Russian education in testimony before a Congressional committee last summer:

"Today we are not educating enough young people, and this is true whether we consider education as valuable primarily for the pleasure and the good that a human being derives from it, or whether we recognize it as the single most important element in national strength—the greatest protection for our country's freedom and prosperity. In 1957, the Russians had 1,475,000 scientific and professional people—we had 1,330,000. This is about a 10-percent imbalance in favor of the Soviets. But there is another significant thing: 30 percent of the Russian scientific and technical people hold degrees that are higher than our own, degrees that correspond to what we normally call a Ph. D. degree. The latest estimate is that by 1961 Russian manpower will probably increase to 2 million, or about 25 percent larger than the estimated U.S. strength of about 1.6 million. The disproportion in acadamic degrees will be even greater than it is today because the Russians are improving their education not only massively but also in quality . . ."

Russian schoolchildren learning about internal combustion engines in a physics class. Many of the students receive additional mechanical training through practical work in factories.

Many Russian technicians and factory workers continue their education through night classes and correspondence work. Here a milling machine operator who attends foreign language classes reads German newspapers to his fellow workers.



A typical laboratory scene in an American electrical engineering class.

is generally selected by the student himself, often as a result of his pre-diploma industrial practice session and sometimes with financial support from industry."

Curriculum in the engineering institutes is generally closely integrated with that of the ten-year general school, the basic institution of the Soviet educational system. Emphasis in these ten-year schools is placed heavily on mathematics, science and foreign languages, a factor which many observers believe is the key to much of the success of education at the higher levels.

THE basic curriculum offered in the general school is substantially standard throughout the country. It includes:

Grades 1-3: Russian language and literature, arithmetic, drawing, singing, physical education, and introduction to manual training.

Grade 4: History, geography and elementary biology are added to the subjects taught in grades 1 to 3.

Grades 5-10: Russian language and literature, foreign language, history, arithmetic, algebra, geometry, trigonometry, physics, chemistry, botany, zoology, anatomy, Darwinism, geography, astronomy and drafting, polytechnical training (agricultural and industrial training), drawing, singing and physical education.

The severity of the curriculum of the ten-year schools is reflected in the final examinations which are required in each of the major subjects before the student is presented with what is known as a "Certificate of Maturity" attesting to successful completion of the courses.

In a publication entitled *Final Examinations in the Russian 10-year School*, the Office of Education described the examination procedure this way:

"During part of May and June of each year, Soviet school boys and girls who have completed the regular 10-year school program face an experience which is crucial to their future careers: a final examination in each of the major subjects which they have studied during the years behind them. . . . The principal aims of these final tests are stated to be to verify the amount of knowledge acquired by the 10-year students and to reveal their development, independence of judgment and ability to relate knowledge with life—theory with prac-

Engineering Curriculum in USSR

Subject (Turbine Design Course)	Total, hr.		Lecture, hr.		Laboratory, hr.		Recitation, hr.	
	a	b	a	b	a	b	a	b
Principles of Marxism & Leninism	256	250	156	160			100	90
Political economy	140	140	100	100			40	40
Foreign language	256	252					256	252
Higher mathematics	408	408	220	220	16		172	188
Physics	274	274	170	170	70	70	34	34
Chemistry	104	104	36	36	68	68		
Descriptive geometry & drafting	276	278	54	54			222	222
Theoretical mechanics	200	215	134	115			66	100
Strength of materials	226	232	140	133	34	33	52	66
Mechanisms & machines	100	197	64	80		20	*36	*97
Metal working & shops	348	386	144	182	204	204		
Detail design	174	215	110	85		15	*64	*115
Electrical principles	180	162	96	100	56	32	28	30
Interchangeability & tolerances		34		24		10		
Thermodynamics & heat transfer	222	233	148	199	46	14	28	20
Hydraulics	108	102	90	68	18	15		19
Steam & gas turbines	276	323	170	230	50	52	*56	41
Lifting & transporting machines		116		32				*84
Gas dynamics		134		90		16		28
Metallurgy		135		90		45		
Technology of turbine construction	152	70	132	60		10	*20	
Electric power stations		52		52				
Thermal measurements	72		36		36			
Compressors	56	78	42	65	14	13		
Automatic control	56	65	42	52	14	13		
Fuels & boilers	132		112		20			
Combustion chambers**	56	70	56	14				*14
Instrument maintenance aircraft gas turbine**		56		48		8		
Heat exchangers**		52		42		10		
Aircraft gas turbines**		65		52				*13
Economics & administration of industry	100	86	86	86			*14	
Safety engineering & fire prevention	42	42	42	32		10		
History of mechanics		42		42				
Physical education	136	136					136	136
Totals	4350	4960	2380	2713	646	658	1324	1589

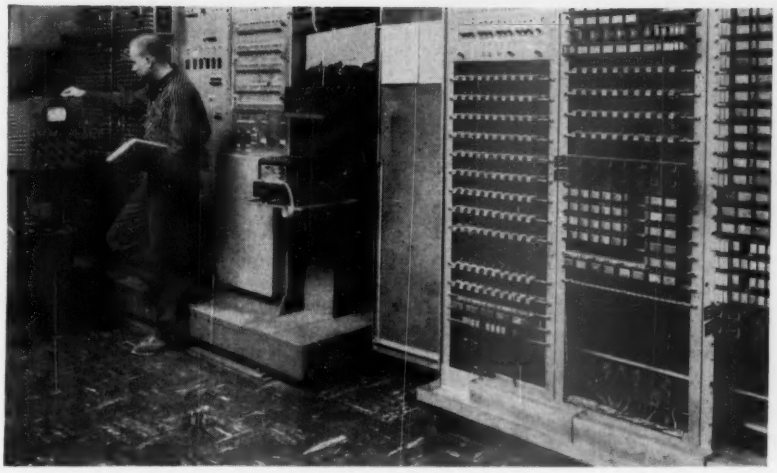
*Projects combined with recitation.
**Special courses for aircraft engine option; for other options other courses are substituted.

tice. The exams manifestly reflect a principal pedagogical effort to have pupils master a prescribed amount of knowledge from textbooks, other required readings and practical work. . . ."

With its six-day-a-week schedule, the Russian ten-year school is roughly equivalent in length of instruction to the American twelve-year system. Education presently is compulsory in the first seven grades, but this is now being extended to eight years in most of the country.

Much of the Soviet educational system is undergoing major revisions this year with many of the changes designed to give a more practical vocational aspect to the curriculum. Until this new program was adopted a large part of the emphasis was placed on college preparatory work in the ten-year school. For several years there had been criticism that this program was neglecting the hundreds of thousands of students that go into industry immediately upon completion of the ten-year school. At the same time it was felt that many of the professional people were losing their appreciation of labor.

William K. Medlin, specialist for Eastern Europe in the Office of Education, reports that the Soviet schools for some years have not been producing a sufficient number of young people with particular vocational, technical and other labor skills. "With enrollments in the three senior grades of the ten-year school mounting to five to six million and annual graduations ranging from one to one and one half million, the ten-year schools have been training too many youngsters in the academic preuniversity line and too few in the vocational and industrially oriented lines of education," Medlin says.



Most American engineering schools are blessed with modern laboratory equipment. Here a graduate student at George Washington University runs an oscilloscope test on a digital computer.

Under the new system which is going into effect in many areas of Russia this year, virtually all of the students whether they are headed for a university or not will receive some work experience during their secondary education. Engineering students, likewise, will get additional practical working experience in industry during their attendance at VTUZ's.

The new system, if it is adopted in its present form, will probably lengthen the ten-year school into an eleven-year course in order to include time for the practical work experience. The engineering schools are expected to be lengthened by about six months to a year to include the additional practical study.

These new developments are being watched closely by American educators who still are seeking to come up with a concrete assessment of the Soviet educational system. There is wide disagreement in the U. S. today on just how Russia does rate in the education race. Reports like those by ASEE, the Office of Education, and Admiral Hyman Rickover have provided valuable insights into the picture, but definitive comparsions are still hard to come by.

L. G. Derthick, U. S. Commissioner of Education, who headed the Office of Education's mission to Russia, makes no attempt to compare the two educational systems, but he does come up with this interesting summation of the problem:

". . . We do emphasize that, whether we like it or not, competition has been imposed upon us by a nation of vast resources, a people of seemingly unbounded enthusiasm for self-development, governed by a ruling hierarchy which is determined to use that self development to cast about the world the shadow of Communist domination.

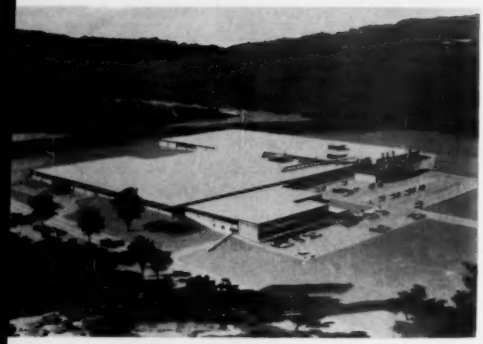
"To sense this issue at first hand is indeed a sobering experience. We came back deeply concerned about our poorer schools now suffering from neglect. But we returned with a new appreciation and renewed faith in the American system as reflected in our better schools where citizens have cared enough and done enough to make the American ideal of a sound education for all come true, or nearly so.

"The question is: Will we Americans work and sacrifice to extend to all of our youth the best in American schools?"—**End.**

American students at work on a problem in a college engineering laboratory. Their Russian counterparts face a more specialized curriculum with a growing emphasis on practical working experience.

Large firms are pleased to cooperate with local planning officials in the location of new plants. Here is the fabulous new multi-million dollar general offices of General Mills, Inc., located in the Minneapolis suburb of Golden Valley.

The Engineer and City Planning



With industry moving more and more into new locales, even smaller cities must now plan carefully for their future development. Shown here is the beautiful new plant of Eberhard Faber near Wilkes-Barre, Pa. The pencil manufacturer moved from Brooklyn after 108 years in New York.

IN the past decade, city planning boards have become increasingly important to community life in the United States, and, because of the engineering function, the profession has taken a great interest in their welfare. This has certainly been the case in Jersey City, New Jersey, where I have had the privilege of serving on such a board as engineer member.

But why should *cities* plan? It is only in the last few years that the subject of planning has absorbed the attention of forward looking people, and a recent report of the National Industrial Conference Board points up this fact. The report states that 74.8 per cent of the large corporations in the United States have vice presidents of planning, and if business has discovered that it cannot operate without organized planning, the same should be true for government.

Luther Gulick, president of the Institute of Public Administration says, "How did this come about? It came about because of the dynamic quality of the American economy, and the pace of social and political changes of recent decades. Change requires planning. The dynamic quality of American life makes it unsafe for business and for government units to proceed without organized foresight. Planning must become a normal habit of approach."

In a rapidly changing environment there are three ways to proceed, three "habits of action." The first is to meet each emergency as it arises; the second, to try to break individual bottlenecks, and the third, to plan, to program, comprehensively in advance.

In a static town that remains largely the same from generation to generation, there is little need for planning. The town can meet each emergency as it arises. When a roof leaks you can put on a new roof; and when a pavement disintegrates you can build a new road. This approach is suitable for a situation where there is little change, and the breakdowns show you where and when something is required.

In the second approach, breaking individual bottlenecks, single problems are identified and solved individually before the emergency is too serious. Whether it be a highway, or a bridge, or a sewer system, the town will have it built. It will put on its blinders to everything else and say, "I am going to build this road through here because this is where the traffic wants to go."

If new problems arise as a result of that road, those will be solved individually as they arise. At the time of building, the immediate job is done and the bottleneck broken.

In the third approach, the approach of comprehensive planning, a longer and "deeper" look is taken at more of the factors which are involved. The planner realizes that highways, bridges, water or sewer systems, or schools, do not exist each by themselves, and that it is necessary to relate water to land use, to circulation; and to plan for all of them together. Comprehensiveness is required.

Comprehensiveness reaches in four dimensions. One is geographical, one is functional, the third is in time, and the fourth is aesthetic, or shall we say, spiritual. Planning is not comprehensive unless the territory covered extends to the major boundaries of the thing one is talking about; planning is not comprehensive unless it knits together the major interrelated functional strands of community life; planning is not comprehensive unless it deals with the past, present and future, over a meaningful span of years, and finally, planning misses an important component if it fails to consider man's need for beautiful and spirit-building surroundings.

IN taking this broad four dimensional planning approach as our goal we must be truly modest. Planners have made mistakes in

By
MAXWELL SPIRO, P.E.
President, Maxwell Spiro & Company, Jersey City, N.J.

the past, mostly from following the bottleneck approach and underestimating the growth, dynamism and economic potential of their communities. We will make mistakes in the future. But with good techniques, hard work, common sense, well based and courageous dreams, and solid community commitments to major policies, we will

A familiar sight everywhere is the old making way for the new. Here a 60-year-old building in downtown Minneapolis is being razed. The 110-foot boom is hoisting a small front-end loader to the seventh floor.

at least escape the most prevalent blunders of the past.

Thomas P. Cook, deputy attorney general counsel to the New Jersey State Department of Education poses the question: "Why must a school board, autonomous in our system of government, be concerned with any "master plan" adopted by the municipal planning board? And what does the planning board have to do with the construction of new schools?"

"The answers to these questions stem from one basic and obvious fact: Every public school is but a part, though a vital one, of the whole community which it serves. Not only the school but every civic institution or facility, be it library, park, hospital, public utility or housing project, affects the entire social organism of which it is a member; and the growth of each member should be planned in the light of the inter-relationship of all."

The present Jersey City Planning Board was created in 1953 by the legislature which enacted the Municipal Planning Act, a broad and far-reaching statute which, among other things, repealed the earlier planning act contained in the revised statutes.

It is interesting to determine the construction of a typical planning board, its personnel, staff and its jurisdiction particularly as it refers to the City of Jersey City.

The members of the Board are selected by the mayor in office at the time the vacancy occurs and is for a period of approximately three years; and they serve without remuneration. They have the title of commissioner by virtue of their membership. In addition to the nonsalaried members, the mayor and the commissioner of revenue and finance are also members.

The members of the present Board consist of:

Charles Wollny, chairman. (Lawyer).
Frank C. Ferguson, vice-chairman. (Banker).
Charles S. Witkowski, mayor. (Lawyer).
James F. Murray, Jr., city commissioner. (Lawyer).
Aaron Gorlin (Appraiser, real estate).
Mario Sergio (Architect).
Maxwell Spiro (professional civil engineer).
William O'Keefe (Insurance).
John O'Connell (Real estate, insurance).

The general scheme of the Municipal Planning Act of 1953 falls into two parts: (1) master plans, and (2) regulation of subdivisions. It is the master plan that provides the guide for decisions effecting problems of zoning and expansion.

Section 10 of the Act outlines as follows the power of a Municipal Planning Board to prepare and adopt a master plan:

"The Planning Board may prepare, and after public hearing, adopt, and from time to time amend, a master plan for the physical development of the municipality which generally shall comprise land use, circulation and a report presenting the objectives, assumptions, standards and principles which are embodied in the various interlocking portions of the master plan."

1. The Planning Board shall elect a chairman and create and

Taking part in the nation-wide building boom is Long Island, N. Y., where a new sports arena goes up. The location of such buildings must be selected with great care as traffic and other problems are certain to be encountered.

fill such other offices as it may determine. It may employ experts and a staff and pay for their services and such other expenses as may be necessary and proper not exceeding the amount appropriated by the Board of Commissioners for its use. (R.S. 40:55-1.5.)

2. The Planning Board shall act as the Zoning Commission. (R.S. 40:55-1.8.)

3. The Planning Board may prepare and after public hearing adopt, and from time to time amend, a master plan. (R.S. 40: 55-1.10.)

4. The Planning Board shall within forty-five days after reference thereto by any authority or public agency (such as housing, parking, highway, redevelopment, school board or similar

public agency) review and make recommendation upon projects necessitating the expenditure of public funds. (R.S. 40:55-1.13.)

5. Under the Urban Redevelopment Law (R.S. 55:14E-5) the governing body shall refer to the planning board, applications for public housing projects to report whether proposed project conflicts with master plan or municipal interests.

6. Under Redevelopment Companies Law (R.S. 55:14D-15), the Planning Board shall act as supervising agency in approving plan of projects thereunder.

7. The Planning Board shall make recommendations, within forty-five days, upon adoption of any official map or amendments thereto after reference to Planning Board by the governing body. (R.S. 40:55-1.35.)

8. The Planning Board shall after reference thereto conduct preliminary investigation of blighted areas. (R.S. 40:55-21.2.)

9. The Planning Board, acting as the Zoning Commission, shall, prior to the adoption of any zoning ordinance, recommend the boundaries of the various districts and the regulation of a zoning ordinance. It shall first make a preliminary report, thereafter hold public hearings, and then submit its final report to the governing body. (R.S. 40:55-33.)

10. The Planning Board, where a zoning ordinance is to be amended, changed, modified or repealed, or the boundaries or use district, changed, shall, after submission to it of the proposed amendment or change, have not less than thirty days for consideration and report, and shall make its report to the governing body, approving or disapproving the amendment or change. (R.S. 40:44-35.)

11. Notice of hearings shall be published in a city newspaper at least ten days prior to the hearing. Notice of hearing shall contain a brief description of property involved, location, a list of maps and documents and a summary statement of matters to be heard. Maps and documents shall be filed with the city clerk for public inspection. Minutes shall be taken and filed with city clerk for public inspection. Minutes shall include names of persons appearing, attorneys, etc., action taken, findings and reasons. (R.S. 40:55-1.7.)

In general, Section II of the Act specifies that the master plan may encompass the use of land and buildings, services (such as water supply and utilities); transportation (including streets, parking, public transit, etc.); housing conservation, public and semi-public facilities (including schools, libraries, parks, playgrounds, etc.); the distribution and density of population, and other elements of municipal growth and development.

We have seen the great transition that has taken place in New York City and other areas and we must, if we desire at some future date to have more beautiful cities, take a leaf from their book and follow such outstanding engineers and planners as Robert Moses.

The commissioners serving on our Board have lived and worked in Jersey City for many years and are fully aware of the requirements necessary to have Jersey City take its place among the progressive cities of the country.

This is by no means an easy task, but with the cooperation of all, professional men and others, this can be accomplished.

The Jersey City Planning Board will shortly appoint a planning engineer. The question will arise as to what should be the requirements for an applicant who is desirous of obtaining this most important position.

A planning engineer is the focal point around whom the Planning Board will revolve. Such a man should be an executive and one who has had extensive experience in designing and has the ability to visualize the finished product from the blueprint. He should be diplomatic with wide experience in dealing with people and should have the respect of his fellow citizens for his professional capabilities. The test should be: "This is not a political appointee, but an appointment based upon merit."—**End.**

This is the new Central Viaduct, part of Cleveland's inner Belt Freeway, and carrying Interstate Route 71 across the Cuyahoga River, railroad yards, and industrial areas. The section over the Cuyahoga is high enough to permit passage of the big Lake Erie ore boats without interruption to motor traffic, an example of good city planning.

About the Author . . .

Mr. Spiro

Maxwell Spiro is president of Maxwell Spiro & Company, engineers and steel fabricators, of Jersey City, New Jersey. Born in New York City, he received a Bachelor of Science degree from The Cooper Union in 1915.

A civil engineer, Mr. Spiro recently completed a course in planning at Rutgers University.

During World War I, he served in the 82nd Division, 307th Engineers. In World War II, he served as commanding officer of Company "D," 4th Battalion.

FROM WASHINGTON

BY
MILTON F. LUNCH,
N.S.P.E.'s Legislative Counsel

THE POLITICS OF ENGINEERING & SCIENCE

BOTH major political parties have now confirmed what has been rather obvious for some time—engineering and scientific policies and activities have become inextricably intertwined with the public business. By definition, therefore, such policies and activities become a part of the political system and subject to all of the forces which are involved in the constant struggle for political power.

The confirmation on the part of the Republicans came through the issuance of a task force report by the Republican Committee on Program and Progress, established some months ago to spell out a new "image" of the party. It is of some significance that of four scheduled task force reports the first was "The Impact Of Science & Technology." The other areas are national security and peace, human rights and needs, and economic opportunity and progress.

◄ Charles H. Percy

Charles H. Percy, president, Bell & Howell, is chairman of the over-all Republican Committee on Program and Progress. The task force is headed by Charles E. Ducommun, president, Ducommun Metals and Supply Co. Other members of the task force include educators, doctors, architects and engineers.

On the heels of the Republican report, the Democrats unveiled a preliminary and partial statement of their Science and Technology Committee, which is a unit of the Democratic Advisory Council. That group, headed by Ernest C. Pollard, chairman of the Biophysics Department, Yale University, is composed of seventeen engineers and scientists, including such well known names as Harold C. Urey of the University of California, and Trevor Gardner, former Assistant Air Force Secretary for Research and Development and now president of Hycon Manufacturing Co.

It would appear that the two groups are not very far apart in their commentaries—they are in full accord that the role of science and technology is pervasive and must be accorded a higher degree of recognition in the national political structure. It is too early to pinpoint the actual differences, partly because the Democratic report is not complete and will not be issued until December. But it may be expected that the differences between the politically-oriented scientists and engineers on both sides will

Ernest C. Pollard ►

be differences of degree, not unlike the situation which prevails in national politics. And, it may be expected that there will be some political sniping between the two groups —example: Dr. Pollard's comment on the Republican report was: "You can't stop ICBM's with platitudes." Dr. Urey added: "There doesn't seem to be any scientists on this [Republican] scientific task force. Most scientists are now Democrats, but I know some good scientists who are still Republicans and could have recommended some names." It may be anticipated that the Republicans will politely (?) decline to have their people named by a political opponent.

On a more serious basis, what do the two advisory groups have to say about the expanding role of engineering and science? First, the Republicans call the future the "Age of the Intellect" and believe that the Federal Government should promote and support science, but never control it. They are for freedom of inquiry and progress through the "vigorous, competitive efforts of private agencies, foundations and industries." The GOP'ers point to 1976, the 200th anniversary of the signing of the Declaration of Independence, as a focal point in terms of automation relieving workers of drudgery, world-wide sightseeing in three or four days by jet travel, men on the moon, food for all

hungry people throughout the world—all to be accomplished through the miracles of engineering and science.

To reach these goals, the task force calls for greater public understanding of the work of those in technology, decentralization of research with a minimum of Federal control, programs to meet the growing demand for scientists, engineers, technicians and skilled workers, and providing "engineers and scientists with economic resources with which to pursue their search with the utmost aggressiveness."

◄ Charles E. Ducommun

Being a little more specific, the Republican body wants to strengthen the content of courses in mathematics and science at both the secondary and undergraduate college level. The continuation of efforts to improve the economic and social status of teachers at all levels is noted, as well as encouraging colleges and universities to provide appropriate scientific education to the nonscientific student. In the educational area, the group also favors improving the number and quality of undergraduate and graduate schools of engineering and science and the modernization of engineering and scientific curricula "to attract able students to this important field." The hearts of education and research officials will be gladdened by the support for "reasonable charges for overhead and management when contracts for research in science and engineering are made with educational institutions."

On the controversial question of the organization of engineering and scientific activities within the Federal Government, the task force comes out flatly against a Department of Science, but urges a civilian science advisor with immediate access to the President (which now exists), a Presidential Science Advisory Committee and a Federal Council for Science and Technology "to facilitate cooperation among Federal agencies in the planning and execution of their respective scientific and engineering programs."

The specifics of the Democratic program remain to be enunciated in the forthcoming report, but the preliminary statement indicates that there will be considerable emphasis on the role of science and engineering in "waging peace." For example, the group wants to establish a large scientific laboratory to work out the technical problems in such areas as disarmament and nuclear radiation. The Democratic group is also likely to be quite critical of Administration policies of recent years as evidenced by the preliminary comment that the President has failed to take advantage of a "tremendous opportunity" to awaken the nation to the deficiencies of its educational system. Americans have been fed "intellectual tranquilizers" instead, the Committee charged.

The Democratic statement touched on a point which has intriguing possibilities for the engineering profession—inclusion of a plank on engineering and science in the Democratic platform of 1960. Obviously the same possibility exists for the Republican platform.

In his opening message to the recent NSPE meeting in Pittsburgh, President Harold A. Mosher declared that "the political party that does not include a meaningful science and technology 'plank' in its platform for the 1960 elections cannot be entrusted with the formulation of national and international policy during the coming years." He mentioned such related political-engineering topics as atomic energy, solar exploration, and education in calling for the translation of "general" statements issued by both parties into "specific" items in the party platforms which will be used in the 1960 election campaigns.

Harold C. Urey ►

The emphasis on "meaningful" and "specific" is all-important. The political parties can hardly be expected to enunciate the real and hard issues unless they have some guidance from the engineering and scientific community, even though both parties have committees of highly qualified individuals. If the call of President Mosher is to be heeded the time is at hand for the engineering profession to be prepared to take real recommendations to the platform drafting committees next summer. And to do that means some hard choices of policy in highly controversial areas.

In addition to those areas of related interest already mentioned by the respective committees of the political parties, the profession can wrestle with and recommend the course of national policy which it feels will best serve the national interest in other areas. As an example, to pick one of the most difficult: There is now new serious talk of a further reorganization of the military structure. Has the time arrived when all military agencies should be brought into one under the whiplash of technological domination of defense planning and techniques? If so, (or even if not) should the engineering and scientific military operations be consolidated into one truly professional corps with appropriate subgroupings for various technical specializations?

To do what President Mosher advocates will put the profession into politics with a big "P." The thin line which has kept professional activities out of political activity (or at least it was so thought) has ceased to exist. The political parties have, in effect, invited the engineering and scientific community into the political arena—"The Greatest Show On Earth." If the challenge is accepted it may be rough and tumble and a few bruised shins (or feelings) may result. To decline the offer, however, will be to turn down the chance the profession has sought for many years: A place in the sun of prestige and importance in arranging the affairs of mankind.

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Realizing the Highest Potential Of Engineers in Industry Through Advanced Education

By

DR. WARREN C. STOKER

Director, Hartford Graduate Center, Rensselaer Polytechnic Institute

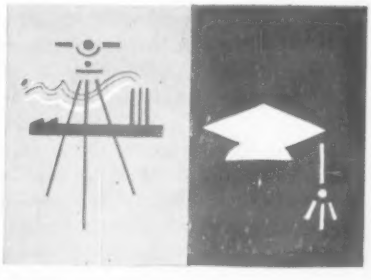
SINCE I am the author of the text, but not the title of this article, I feel that I may take some liberty with the interpretation to be placed upon the title. I propose to interpret advanced education to be that of formal graduate study. However, the preliminary views which I wish to make are not restricted to the field of graduate study alone but will apply to any interpretation one wishes to place on the meaning of advanced education.

My first views will be addressed to the need for advanced education. Technology has been progressing at a very great rate, greater than ever in history, and this has made the education of engineers obsolete in many, many instances. For instance, there are totally new fields which have come into being since World War II, such as, nuclear energy, and servomechanisms, or automatic control, or cybernetics. Another totally new field is that of solid state electronics with its transistors and masers. Another example, of course, is that piston engines have been replaced by jets which are even now, perhaps, being replaced by rocket engines. These rapid advances in engineering and science cannot help but create the need for further study on the part of those who completed their formal engineering education prior to the war or even in the years immediately following the last war.

It is imperative that this "retreading" be done in order to realize the full potential of engineers who already possess professional attributes which only experience can produce.

Another factor that makes the need great for advanced education lies in the fact that undergraduate engineering education has changed and is still changing. There has been a trend on the part of engineering schools to devote more and more time to subjects in the areas of humanities and liberal arts, and, of course, this has made inroads on the time available for engineering application courses. There has also been the need for an added emphasis in basic sciences and in the engineering sciences, and this again has brought about a reduction in the time that can be devoted to strictly engineering courses. Inevitably this change that is taking place in undergraduate engineering curricula is going to accentuate the need for graduate study on the part of engineers in the future.

There were many changes occurring immediately after World War



II in areas other than the strictly technological aspects of engineering. The students coming into the engineering schools were quite a different group from those prior to the war. The G. I. bill brought about a great change in our student bodies in that the veterans comprised a major portion of the enrollment. Of course, veterans for the most part were older than the students to which we were accustomed. Furthermore, they were married. This created a different atmosphere on our campuses. They were more mature and, for the most part, better motivated.

The large enrollments which the G. I. bill helped to bring about also brought with it a teacher shortage, and this resulted in modifications in the schools; one of which was that it was necessary to use considerably greater numbers of graduate assistants who would teach part-time and study part-time. These graduate assistants were able to gain some financial support, also, through this part-time employment as teachers. The colleges were also undertaking expanded research programs with sponsorship and used, again, graduate assistants in the roll of research assistants where they were able to carry a half-time study load and engage in research work on a half-time basis. Tuition scholarships were a regular part of these assistantships.

Many of the urban universities found that it was necessary to expand their evening schools to accommodate the great demand for education after hours on the part of those who wished to continue their education while being employed.

Of course, not only did the students in the schools change, but many industries themselves were changed. In some instances, an industry's product changed quite radically, such as we referred to earlier where a producer of piston engines changed over to jet engines. In other instances, there were many totally new industries created in areas where there had been none before; for example, the AEC plants at Oak Ridge or the Savannah River installation. Many of these relatively large installations employing considerable numbers of engineers were in areas where there were no graduate facilities available for education.

As a direct consequence of the need for advanced education of which the engineers were aware, along with the awareness also on the part of industries that this need existed, several new patterns of graduate education have arisen during the past few years.

One of the most important features of graduate engineering education today is that very few of those undertaking advanced studies pay for this education completely themselves. It is very nearly the rule that graduate engineering education is at least partially supported through fellowships or scholarships or assistantships, either in research or teaching. Many of these fellowships and scholarships have been set up by corporations for their employees.

A second characteristic in the new patterns in graduate engineering education is that of the part-time feature. I'd like to present a very few statistics taken from a survey conducted by the ASEE Graduate Studies Committee during 1957, which reveal this trend. These figures have been compiled from eighty-nine schools of engineering across the United States.

NUMBER OF GRADUATE STUDENTS

	Full-Time	Part-Time			
		On-Campus		Off-Campus	Total
		University Employed	Gov't or Industry Employed		
1948	4227	3890	2740	698	11,555
1952	3594	3035	8344	2026	16,999
1956	5767	4228	9968	3713	23,676

You will note that these figures indicate that there has been a growth of over 12,000 graduate students in a period of eight years, that is, the population of graduate students has doubled. There was only slight growth in the number of full-time students, this being approximately 1,500. Most of the increase has taken place in the number of part-time graduate students. In this category the number of graduate students on university campuses as assistants, either research or teaching, increased only slightly while the bulk of the increase, 10,200, has occurred either in part-time programs on campus, usually evening programs or at off-campus locations, either in extension or at off-campus centers. Some of the schools now having large part-time, on-campus graduate attendance are: Brooklyn Polytechnic Institute, UCLA, University of Cincinnati, Columbia University, Drexel, MIT, CCNY, Newark College, Northeastern, Northwestern, University of Pittsburgh, University of St. Louis.

A significant new pattern in graduate engineering education has been the introduction of Off-Campus Centers. To help clarify the meaning of this name, a brief explanation of off-campus activities in general may be helpful.

Off-campus programs, of course, result from bringing the education to the location of the student body where no educational facility exists in the area. This has been done for a good many years by universities, and such programs have been called extension programs. Quite typically a class meets in some local facility, either a high school or in a room provided by an industry and the university sends one of its professors to meet with the class. Frequently the instructor is drawn from local industry if the distance from campus is quite great and if suitable instructors can be found locally. Quite commonly the class meets once a week, and again quite commonly this is a three-hour session.

An off-campus center is really a branch of a college established at the location remote from the main campus. Some of the features provided by such off-campus centers include resident administration, a nucleus of resident full-time faculty, a library, and similar facilities to be expected on a college campus.

Off-campus centers have been established by the University of Wisconsin, Syracuse University,

and Rensselaer Polytechnic Institute. More recently, centers have also been established by Brooklyn Polytechnic Institute on Long Island and by New York University at the Bell Laboratories in New Jersey. It is significant that in most instances these centers have been developed with the cooperation of industry.

I would like to describe in some detail one of these off-campus centers which has been considered by many to be an outstanding example in which good educational practices have been combined. This is the Hartford Graduate Center of the Rensselaer Polytechnic Institute which was established near Hartford, Connecticut, in 1955. It was founded with the cooperation and support of the United Aircraft Corporation.

The Hartford Graduate Center, a branch of Rensselaer Polytechnic Institute, Troy, New York, was brought into being to provide graduate education in science and engineering in an area lacking such a facility, but having a large number of working engineers.

THE single largest industry in the Hartford, Connecticut region is the United Aircraft Corporation with its Pratt & Whitney Aircraft Division in East Hartford and the Hamilton Standard Division in nearby Windsor Locks. UAC is one of the leading developers and suppliers of jet engines. It felt that graduate education for its engineers was a vital necessity to the future well-being of the corporation. However, degree programs at the graduate level in engineering and science were not available in the Hartford area, so the UAC decided to see what could be done to meet this educational need of the area.

Since the United Aircraft Corporation was confronted already with a shortage of engineers, the problem was one of making available degree programs at the graduate level on a part-time, late afternoon-evening schedule, so that the engineer pursuing a graduate study program could remain a productive engineer. The UAC recognized also the necessity of an educational facility close to the industrial community so that travel time would not consume an undue amount of the engineer's free time. Rensselaer Polytechnic Institute, along with several other schools of engineering in the East, was approached by UAC and asked to submit its proposal for meeting the above objectives.

The proposal made by RPI was selected; and so the Hartford Graduate Center of RPI was conceived in the late spring of 1955. In brief, the Rensselaer proposal called for the establishment of a branch of RPI in the Hartford area. The branch would offer initially graduate degree programs in four closely related major fields: namely, aeronautical engineering, mechanical engineering, mechanics, and applied mathematics. The graduate school would operate under the same rules and regulations and with the same standards of admission and course instruction as the graduate school on the main campus. The Hartford Graduate Center would be open to all qualified students (not those of UAC alone). The Graduate Center would have its own campus with a complete educational plant. The staff and faculty would be full-time and resident. In other words, this would be a true branch, not just an extension activity. Students in attendance at the branch would be in residence.

The only financial basis upon which RPI could undertake such a venture as the establishment of a complete, new branch, at a distance of 120 miles from its main campus, and in another state was one which would entail no financial loss. The United Aircraft Corporation set up a fellowship plan which assured a student body. It also agreed to provide a suitable classroom facility at a location under RPI's control alone.

It has been necessary to meet all operating costs from current income since it would be unethical if not illegal to utilize income from endowments established at the parent campus for support of activities at another city and in another state. This has resulted in a high tuition rate. It was estimated on a basis of experience at Troy and before the operation was underway at Hartford, that eventually the actual cost might approach $65/cr. hr. This figure has been the published tuition rate. The actual cost has been considerably higher than the above figure but as the enrollment has increased, the cost per credit hour has been decreasing.

Since the income from tuition falls short of meeting the operating costs, the difference must be met by grants. These have been secured from industries whose employees are attending the Center. It has been our policy to seek grants from such sources in proportion to the number of credit hours for which their employees have registered. There are currently fourteen corporations in addition to the four divisions of United Aircraft Corporation which participate.

An existing modern building located in a suburban area convenient to any part of the Hartford area was purchased and converted into an educational plant comprising within its 24,000 square feet of floor space, eight large classrooms, two seminar rooms, an auditorium, lounge, cafeteria, library, and staff and faculty offices. There is parking space for 350 cars. The classrooms were provided with the necessary equipment including sound movie projectors, and desk calculators. The completed structure with all its equipment has been valued at $625,000. It was given outright to RPI by UAC.

THE Hartford Graduate Center has its own library which is intended to provide for the educational needs of the students in the fields of major interest. Under the supervision of a full-time librarian, the library currently holds 3,700 books, 1,200 bound volumes of serials, and 215 serial titles are currently received. In addition, the facilities of the RPI library at Troy are fully available and those of public, college, and industrial libraries in the Central Connecticut area are available through a union list of periodicals in addition to the usual cooperation existing between libraries in the region.

To ensure that graduate work at the new branch would be a continuance of that at the main campus, a nucleus of six full-time professors was transferred from the Troy campus to the Hartford campus. Other full-time professors were brought directly into Hart-

ford. The full-time staff now consists of six full professors, and two associate professors. In addition to the full-time faculty, some adjunct (part-time) professors have been obtained from the industries in the Hartford area. There are now twenty-seven adjuncts associated with the Center. Of course, only part of this group teach in any one semester. The full-time staff teaches two-thirds of the classes. The adjunct professors usually teach the courses of a specialized nature.

The Hartford Graduate Center has been made a separate division of the Institute. As such, it is administratively independent of academic departments on the main campus. The local administration consists of a dean who has over-all responsibility for the operations and a manager who takes care of nonacademic matters such as office administration, supervision of grounds and buildings, purchasing, and cafeteria operations. All graduate matters for RPI as a whole are under the general control of the graduate council which is composed of representatives from the various academic departments at Troy and several from the Hartford campus along with such administrative officials as the director of admissions and registrar. The graduate council and its Executive Committee are under the chairmanship of the dean of the graduate school. All academic matters relating to graduate study are within its province. Through the common control exercised by the graduate council over all graduate programs, the graduate program at the Hartford Graduate Center has been very closely allied to that on the main campus. This has been further assured through a common office of admissions, there being only one standard of admission. Courses offered at the HGC for the most part follow the common catalog number and description of those at Troy.

During the four years of its existence, the course offerings and majors available have been increased and now include majors as follows: mathematics, mechanical engineering, management and engineering science. Options available under engineering science include aeronautical science, automatic control, data processing, electrical science, mechanics, metallurgy and nuclear science. The degree which is awarded is that of Master of Science in a designated field, e.g. M.S. in M.E.

The schedule of classes has been arranged to permit a student to pursue a maximum of two courses per term, with involvement of not more than two evenings per week. The vast majority of the courses are three credit hours. Since a minimum of 30 credit hours are required for a Master's degree, a student may earn the Master's degree in a minimum of five semesters or 2½ years, if he takes two courses each term. There are two semesters each year with no summer session.

In addition to the former classroom instruction, a regular program of seminars involving student participation is provided by the full-time faculty along with a science and engineering colloquia which brings distinguished engineers and scientists to the Center as speakers. There are active professional society sections representing all of the engineering groups in the Hartford area. These groups have utilized the facilities of the Center for their meetings and, of course, the graduate students are encouraged to attend such meetings.

The United Aircraft Corporation established a tuition assistance plan for its employees under which they may obtain a Master's degree at no cost. To give the employee-student a financial stake in his education program, the UAC plan requires a $20/cr. hr. performance deposit upon registration for each course. If the course is passed, one-half of the deposit is refunded. Upon completion of the degree requirements, the remaining half is refunded. The tuition itself is paid directly to RPI through an educational fund established by UAC with RPI. Most of the other corporations in the area have established similar tuition assistance plans, some being identical with the above, others paying only one-half the tuition charge for the student. Of course, regardless of company affiliation, any student who has been admitted can register for courses upon payment of the published tuition fee of $65/cr. hr.

The first class entered in September, 1955. It consisted of 215 students registered for slightly under 1,000 credit hours of instruction. Twenty-one different courses were offered. In the fall of 1956, there were 350 students registered for 1,600 credit hours, in thirty-one sections involving 26 different courses. In the Fall of 1957, there were 444 students registered for 2,217 credit hours in forty-one sections and thirty-three subjects. The Fall of 1958 saw an enrollment of 475 students and 2,257 credit hours.

Although the majority of the students were employees of the United Aircraft Corporation during the first term, there were a few students enrolled from other corporations from the outset. The number of corporations in the area participating in the plan has increased, and there are presently employees of twenty-three different corporations registered at the Hartford Graduate Center.

To summarize, the salient features of this new graduate school are:

- Complete control of program, faculty and facility is exercised by Rensselaer Polytechnic Institute through resident administration and faculty.
- Unity in the graduate programs of RPI is preserved through a common graduate council, office of admissions and catalog, and through close liaison between the faculties at the branch and the main campus.
- A strong nucleus of full-time resident faculty has been provided at the branch.
- The adjunct (part-time) faculty has been integrated with full-time into one faculty unit.
- The school is open to all qualified applicants.
- The new school is a fine example of interstate cooperation.

The graduate program described has been a notable experiment in the direction of enabling engineers to realize their highest potential through advanced education. Some measure of the success of the program at Hartford may be found in the fact, that since its establishment, 168 engineers have earned degrees, ninety-five having graduated during this past year.—**End.**

The Role of Technicians in Conserving Engineering Brainpower

By

A. C. FRIEL, P.E.

Chairman, NSPE Committee on Engineering Technicians

ONE of the first problems we face is how to produce an awakening on the part of the engineer to the fact that the technician does exist now in fairly large numbers and that more and more of them are going to come into being in the near future.

The engineer needs to recognize that the technician is available to assist him now and will be more available in a few years. With the recognition of the fact that the technician is available there also needs to be a recognition on the part of the engineer that it is to his advantage to have the engineering technician pick up some of the routine duties that have been so bothersome to the engineer in the past.

There needs also to be a recognition on the part of the engineer and an acceptance of the fact that many of the duties he has performed in the past can be performed just as well by the engineering technician. In some instances the engineering technician can perform certain duties better than the engineer. The engineers need to recognize that many aspects of the total engineering effort do not require the services and talents of a four-year engineering graduate and that for him to spend his time on this type of endeavor is a great waste of talent. Therefore the engineer, from now on, should be thinking about bringing himself to an acceptance of the fact that his services are not needed in certain areas and that he should in the future expect to be working at a higher level of intellectual effort than has been required of him in the past.

Any new situation will meet with the human characteristics of "resistance to change" and this one will be no exception. Therefore we have a job to do in selling to some of the members of our own profession the desirability of making use of the technician in engineering. I state "desirability" as though it were a foregone conclusion. This will be a debatable point, but my belief is that the idea is desirable.

WE need, of course, to know about whom we are talking when we speak of engineering technicians. This could be a whole subject in itself but I am not going to try to explore it to that degree. Let's content ourselves by looking into it far enough to say that in general engineering technicians would be those people who operate in the field related to engineering which lies between that which can be handled by a high school graduate and a professional engineer. There is need for a consolidation of our thinking with respect to the work of a technician. Some of us think of a technician as a skilled mechanic. At the other end of the spectrum there are those who think of the technician as a person with a Ph.D. degree working in a highly specialized technical field.

Until there is a meeting of the minds by a majority of us as to just what a technician is we are going to have some considerable confusion and, as a result, probably some divergence of opinion among us as to what our attitude toward technicians should be.

This problem is becoming fairly well recognized and as a result some steps are being taken to resolve it. In 1953, ECPD adopted a definition of engineering technicians which the NSPE Committee on Engineering Technicians has asked its Board of Directors to adopt for the time being. Other definitions have been developed. ASEE developed one and so, I believe, did the President's Committee on Scientists and Engineers.

The NSPE Committee felt that it could have developed one of its own. However, until we get a little more operating experience which would give us concise information on which to do so, the Committee believed there was no point in adding to the confusion by developing another definition which probably would have to be revised later anyway. It therefore decided to accept the ECPD definition as a basis on which to build later if necessary. The ECPD definition was selected principally because of the fact that it confined itself to "engineering' technicians and did not attempt to cover "scientific" or any other type of technician. This was considered to be desirable because we believed there would probably be resentment on the part of the scientists if we started to enter their field.

The ECPD definition is as follows:

"An engineering technician is one who can carry out in a responsible manner either proven techniques which are common knowledge among those who are technically expert in this branch of engineering, or those specially prescribed by professional engineers. Under general professional engineering direction, or following established engineering techniques, he shall be capable of carrying out duties which may comprise: working on design and development of engineering plant; draftmanship; and erecting and commissioning of engineering equipment, or structures; estimating, inspection, and testing engineering equipment, use of surveying instruments, maintaining engineering machinery or engineering services and locating faults, operating, maintaining and repairing engineering plant, or activities connected with research and development, sales engineering and representation, servicing and testing of materials and components advising consumers, and training and education.

"In carrying out many of these

duties, the competent supervision of the work of skilled craftsmen will be necessary. The techniques employed demand acquired experience and knowledge of a particular branch of engineering, combined with the ability to work out the details of a job in the light of a well-established practice.

"An engineering technician, therefore, requires a background sufficient to enable him to understand the reasons and purposes of the operations for which he is responsible."

With this definition as a background, the NSPE Coets (Committee on Engineering Technicians) is currently thinking in terms of three grades of engineering technicians and one grade of engineering technologist. The first of the three grades would be open to those with a high school education and about two years of experience in the field. The last grade would be open to those who have the equivalent of a two or three year technical institute curriculum leading to the associate degree in engineering.

The Task Force on Instrumentation Technicians of the Instrument Society of America, under the chairmanship of A. G. Hathaway of United Electronics Laboratories, is conducting an extensive survey to establish a concise definition of instrumentation technician. This is expected to be completed some time during the third quarter of 1960 and should be very helpful to the NSPE Coets and others.

There may be, in the future, need for many definitions of engineering technicians covering the various fields such as, electrical, electronics, mechanical, chemical, highway, instrument, etc.

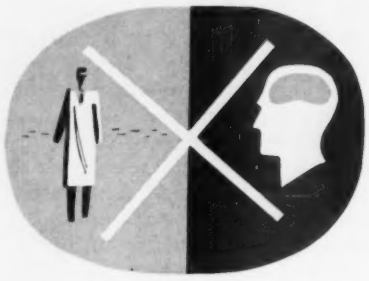
WE have previously made note of the fact that there is now in existence a considerable body of technicians, and there are going to be many more in the near future.

When any large group of people with a common interest band together it is inevitable that such a group will seek to develop ways of securing for itself the status to which it is rightfully entitled. I believe the technicians will be no exception to this. They will wish to attain a suitable degree of recognition and will want to organize.

Two avenues of approach to organization devoted to their objectives came to mind immediately. One is through the professional type of organization, the other through a union approach.

Since the engineering technician is going to want recognition, and should have it to any degree he is entitled, the chances are he is going to get it.

However, the engineering profes-



sion must face the question as to whether it wants the technician to look to engineers for guidance and assistance or whether it wants the technician to turn to the union.

The Coets believe the answer to this question is practically self-evident. We believe the best interests of the engineering profession, the engineering technician and the general public can best be served by the professional engineer and the engineering technician working hand-in-hand as a cooperative team having the same philosophy. If the technicians unionize they will be operating on a philosophy which is completely divergent from that of the professional engineer. They may then become opposing forces working against each other to the detriment of both.

In fact the number of engineering technicians may very well exceed the number of P.E.'s in the ratio of about 3-to-1 and could possibly overshadow the engineer. There might be a possibility of an engineering technician union dominating the engineer, or at least bring unionism much closer to him, thereby making it increasingly difficult for the engineer to fend off unionization attempts on himself. For these reasons alone, and there are others, we think the engineering profession should take an interest in the engineering technician and assist him in his attempts to gain recognition and status.

This is another of the problems we face within our own profession with respect to recognition for the technician. So far I seem to see quite a bit of interest in the technician in some areas, but not enough general recognition of a problem that confronts us and consequently not enough action to date.

IN the original charge to the NSPE Coets the question was raised as to what should be the relationship of the engineering technician to NSPE. Under this general question a second question arises: Should some sort of affiliation be provided for technicians with NSPE? This gives rise to four other questions:

1. Should there be a separate organization for engineering technicians which would be endorsed, promoted, assisted, and advised by NSPE?
2. Should the organization take the form of a functional section (similar to sounding board affiliation)?
3. Should there be a subordinate grade of membership for E.T.'s within NSPE?
4. Should there be no direct recognition of E.T.'s by NSPE?

In considering these four latter questions let's begin by recognizing that the technicians do need a place into which to fit. They need some organization through which their need for a "sense of belonging" can be fulfilled. If we don't provide this for them, they will provide it for themselves eventually, and perhaps in a manner unsatisfactory to us.

Therefore something needs to be done and it is felt by many that it needs to be done quickly.

There are a few places where they can now "fit in" in a very informal way. These places are in the form of local membership in certain AIEE sections and perhaps in other founder society local sections and the IRE. These places *are* very informal and as now set up do not provide the technicians with a distinctive position that provides them with any appreciable degree of status or recognition. They do not have a spot they can call their own.

Further, there are, I believe, areas in which technicians exist but in which there is no technical society into which they can fit. So here is an area that needs something done about it perhaps more than others.

Some effort is being put into consideration of these problems of the engineering technician by EJC that I know of, and perhaps by others of which I don't know. In any case we believe that NSPE should contribute some leadership in the affairs of the technicians. It is our opinion that there is not enough being done fast enough. Therefore the Coets believes that NSPE should interest itself in the affairs of engineering technicians.

So this then provides Coets answer at least to question 4, i.e., should there be no direct recognition of the engineering technicians by NSPE? Coets believes there should be recognition, at least, and it currently believes that this recognition should take the form of a certification procedure similar to that developed by the Association of Professional Engineers of the Province of Ontario.

The Coets believe that it would be desirable for NSPE to develop the certification program and disseminate the material covering the program on a national basis in order that there may be a uniform program throughout the country instead of having fifty different programs as would be the case if each state were to develop its own.

The administration of such a program might be handled by the various state societies or possibly by the technical societies or by ECPD, or others. This presents a problem which must eventually be resolved but we believe NSPE should at least develop a presentable program for administration either by itself, or by the state societies, or others, as the NSPE Board of Directors may think desirable.

This would give us an ideal situation with respect to uniformity. Of course we cannot expect to force a situation which we believe to be ideal on others, but we can start with what we think is ideal and retreat only as far from the ideal as absolutely necessary. We realize that we will have to accept compromise.

Now, referring back to the first three questions, i.e. 1. Should there be a separate organization for E.T.'s? 2. Should the organization take the form of a functional group (similar to sounding board affiliation?) and 3. Should there be a subordinate grade of membership for E.T.'s within NSPE? The Coets believe that there should be no grade of membership within the NSPE structure for E.T.'s. It does believe that either the technical societies should provide a class of membership for the E.T.'s similar to the organization set up of On tario or that of the X-ray technicians associated with the medical profession. In the two cases just cited there are representative advisers from the engineering and medical professions respectively on the governing boards of the societies of technicians.

The Coets believe that NSPE should concern itself with the status and related problems of the E.T.'s, that ECPD should concern itself with their formal educational development, and that EJC through its various technical constituents should concern itself with their technical development.

ASSUMING that the idea of a certification program for E.T.'s is accepted, another question immediately arises which is: How many grades or classes of E.T.'s should there be? The current majority of opinion of Coets is that there should be about four, the same as the Ontario Association. Mr. Hathaway, of the Instrument Society of America, says that a preliminary survey on a rather small scale conducted by him indicates that industry wants several grades of E.T.'s.

This is another question awaiting resolution.

In the area of employment conditions of technicians there are four items set up for consideration in the original charge to the Coets. These are:

1. Relationships with professional engineers.
2. Relationship to registration.
3. Concern with employment position—i.e., overlapping of higher positions of technicians with junior engineering positions, complete career patterns for E.T.'s, and progress to engineering positions.
4. Utilization of E.T.'s.

In regard to item 1, we believe that engineering technicians should not hold membership in NSPE, but that NSPE should be interested in the affairs of E.T.'s, should recognize them as valued members of the total technological team, should work hand-in-hand with the E.T.'s, and should do all it can consistent with its own policies to encourage the E.T. and to enhance his position and status wherever possible.

On Item 2, relationship to registration, the Committee believes that there is no real justification for the legal registration of engineering technicians. There were, in Ontario, efforts toward legislation for registration of engineering technicians. While the Committee does not know of any such efforts in this country, it believes it is logical to assume that this may very well come about in the near future.

This then is another of the reasons why the Committee believes the certification procedure should be developed. This can and will give the engineering technician status without going through a legal registration procedure. The Committee believes that it is desirable that the engineering technician in general work under the direction of the professional engineer and therefore the professional engineer can and should assume responsibility for the work of the engineering technician. It follows then that a legal registration of engineering technicians is neither required nor justified.

On Item 3, concern with employment position, overlapping of higher positions of E.T.'s with junior engineering positions, complete career patterns for E.T.'s, and progress to engineering positions, the Coets is currently thinking in the following manner. It believes there will of necessity be overlapping between the higher positions of E.T.'s and junior engineering positions and it is desirable that it should be so. It becomes pretty obvious that an E.T. with two or three years of technical institute training and twenty-five or thirty years experience in the field is going to be a more responsible and

valuable man on the engineering team than the recent four or five year college graduate engineer. However, as the college graduate gains experience and is able to take charge of work which the technician cannot handle, he will of course move into positions which the E.T. will not be able to fulfill.

We would visualize complete career patterns for E.T.'s beginning with a high school certificate and about two years of experience for the lowest classification to two to three years of technical institute training with up to about ten to twenty years of experience in the highest classification which would place him just below the professional engineer.

WITH respect to progress to engineering positions for E.T.'s I believe I can say that the Coets would currently take the position that the door should never be closed to anyone. If the E.T. can procure the equivalent of a four or five year engineering degree and/or can pass the registration exams then he should be recognized as a fully qualified engineer and in fact, a P.E. if he passes the registration exams.

Here we see the desirability of having several grades of technicians. The pathway from graduation from high school to a registered professional engineer without a four to five year college education in engineering is a long hard road and in fact almost impossible for many. Therefore, if we can break this long pathway up into several classifications it will tend to make the climb seem easier with resting periods in between for those that want or need it. This will encourage and assist the E.T. in his efforts at self development. Under such conditions many would be encouraged to work up the ladder a rung at a time where they might be completely discouraged from trying if the whole gap had to be bridged in one or two steps.

On utilization of E.T.'s, I believe that they should be used in any capacity they can successfully fulfill. The engineer now receives in college a good deal more training than he actually uses in most cases. He should be doing the kind of job that will use that kind of training and leave the routine, repetitive jobs to the E.T.'s. We all know there is plenty of work connected with engineering that does not require the services of an engineer.

The original charge to Coets included as an area for consideration the role of the professional society in the education of technicians. This included three phases which are:

1. Vocational guidance for technician careers.
2. Encouragement of technical institutes.
3. Industrial training programs for technicians.

There are problems to be faced in these areas listed and probably in others that have not yet occurred to some of us. In general, the Coets currently believes that the formal technical education of E.T.'s should, in accordance with the AIEE plan be left in the hands of ECPD if ECPD is interested. We feel quite confident that it will be.

The Coets also believes that technical education for E.T.'s after finishing schooling should be fostered principally by EJC, probably in conjunction with its constituent technical societies. We have in mind here technical programs similar to those now carried out by the technical societies for the engineers.

NSPE, we believe, should concern itself, as we said earlier, with the status and related development of technicians.

However, until there is a broader, more definite, and clear acceptance of the AIEE plan the Coets believes that NSPE, in carrying out its present vocational guidance programs for engineers should keep the technician in mind and lend itself on behalf of the technicians in the same manner it does now for engineers.

The Coets also believes NSPE should definitely lend encouragement and any moral support or assistance that it can to technical institutes.

It also believes that NSPE should encourage industry to develop industrial training programs for technicians the same as it does for engineers. It is my opinion right now that Coets would not expect NSPE to develop these programs itself, but to lend encouragement only, where it can.

We don't believe we know all the answers to all of the problems we face with respect to E.T.'s. We have tried to present some of them for your consideration. We have tried also to present the current thinking of the NSPE Coets, as suggesting some possible solutions. We don't hold that our views are the last word. We will be very happy to adjust our thinking in the light of better or more complete study and information.—**End.**

Lessons of the Engineering Utilization Conferences

By

DR. WILLIAM TORPEY

Office of Civil Defense Mobilization

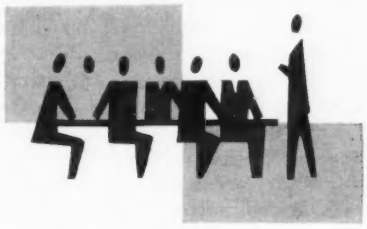
IN 1956, President Eisenhower established the President's Committee on Scientists and Engineers to coordinate and stimulate the nation's efforts to meet growing needs for scientific and engineering manpower. The membership of this temporary Committee

was drawn from major citizens' organizations concerned with the education, training, and utilization of scientific and engineering personnel. One important phase of the total program of the President's Committee has been the utilization conference program. Specifically, the Committee adopted a plan calling for a series of local utilization conferences to be held throughout the United States.

The purpose of such conferences has been twofold: (1) to permit an interchange of ideas on the subject of utilization of scientific and engineering personnel among individuals representing Government agencies, industry, and educational institutions, and (2) to stimulate self-analysis and subsequent "follow-through" action by conferees having manpower responsibilities. A total of nineteen conferences were held under the Committee's auspices during the period September, 1957-December, 1958.

Incident to the termination of The President's Committee on Scientists and Engineers on December 31, 1958, the Utilization Program of the Committee was transferred to the Executive Office of The President, Office of Civil and Defense Mobilization. The Manpower Area of O.C.D.M. has the responsibility for directing and coordinating the development of peacetime readiness programs and emergency plans for the proper utilization and control of the manpower resources of the nation under various emergency situations. To carry out this responsibility requires a manpower organization in place and ready, an adequate knowledge of our present and potential manpower supply and requirements, and action to eliminate or reduce present and foreseeable shortages of manpower. The Utilization Conference Program typifies action through responsible local groups and organizations to reduce or eliminate actual or potential shortages in scientific and engineering manpower. State chapters of the NSPE have played a very vital part in the conference program.

One characteristic of the twenty-five conferences to date has been the multiplicity of professional and industrial organizations and of academic institutions as local conference sponsors. The specific number of persons in attendance has not been considered the determinant of the success of the individual conference; rather, the quality of the program and the enthusiasm of the participants to consider the application of conference material to their own companies are more fundamental to the conference planners. However, attendance at local conferences has usually exceeded local expectations: average attendance has ranged from 100 to 150 participants. Representatives of large and small companies and Government agencies have participated in the conferences. The majority of the conferees have been from top or middle management.



A follow-up plan has been adopted by local planning committees in an effort to gauge the effectiveness of the conference, as well as to provide further help to the participants. Questions included on a follow-up questionnaire are, of course, matters for decision by a local planning committee, but the questions have sought to elicit individual reactions not only to conference procedures but also—and more importantly—to utilization concepts. The follow-up thus has served as a reminder of helpful techniques reviewed at the conference and has sought information from employers about particular utilization policies and practices they follow which may be useful elsewhere.

From the viewpoint of the total conferences held thus far, written evidence obtained by various planning committees during the follow-up indicates that (1) many companies and agencies are seriously considering recommendations made during the utilization conferences with the objective of direct application, and (2) specific changes have been made in policies and practices of particular organizations, with respect to the utilization of engineers and scientists, as a result of the conferences. Other conferees have written to planning committees that conference utilization points backed up company policies which they had already instituted.

The range of suggestions made by participants of the several conferences to conserve scientific and engineering manpower is broad, and includes administrative, as well as personnel, policies, methods and procedures. Some of the suggestions pertain only to large companies, while others apply primarily to small or medium-size organizations. Some are concerned primarily with research and development type operations, but others deal with production operations.

From the pool of suggestions made, six which have potential and direct application to most organizations are:

Engineering Apprentice Program

To the extent that qualified technicians perform subprofessional and nonprofessional duties, scientists and engineers are afforded more opportunities to engage in professional tasks. One method of improving the quality of technicians as direct aids to scientists and engineers in training technicians with the objective that they ultimately may become professional engineers. An illustration of this approach is an engineering apprenticeship program. Under this program candidates are recruited from among high school seniors of several states. In addition to meeting the general requirements set by the company for apprentices, each individual selected for the program must satisfy the requirements of the university for freshman engineering enrollment. The university administers an academic program for apprentices which provides approximately one-half of the credits necessary for an engineering degree. The apprentice also receives at the company rotating assignments intended to develop individual ability. The total program is four years in length. When the

apprentice has completed the academic requirements and 8,000 work hours of the program, he is classified as an engineering technician. After graduation from the engineering apprentice program, the individual may complete requirements for a full engineering degree by attending additional evening classes.

Design Work

Engineers have occasionally complained that they are given subprofessional tasks which fail to challenge their abilities and which prevent their engaging in professional work. The practice of assigning engineers to do design work falls in this category. The use of student assistants is often a practical method to free the engineer for professional duties. Under this program a student alternates every ten or fifteen weeks between classroom study and work in industry. As the work and study program continues, the student gains technical information from his classes and in many ways is able to apply academic learning directly to the work studies in the company. This approach reinforces the learning process, and at the same time keeps the theoretical knowledge on a practical plane. Upon graduation the company usually seeks to find permanent employment for students who give indication of promise.

Use of Computers

Conservation of professional time through the use of computers is growing. Various organizations anticipate that most of their problems in the future which can be economically handled in this manner will be so treated. In some companies large-scale computers are now available on a part-time basis for engineering problems. Company engineers are becoming more familiar with the capability of computers and also with the programming techniques involved in their use. Ultimately these techniques may become almost as well understood and employed as the slide rule.

Tuition Refund Program

There is often a need to equip professional employees with new, different or additional knowledge which cannot be readily acquired through training within a company. In an effort to provide advanced knowledge for optimum performance by scientific and engineering employees, some organizations have established a tuition refund program. After approval by the department manager and after successful completion of a course, an employee may receive a tuition refund if the course (a) provides the employee with a new, different or additional knowledge or skill necessary for the most effective performance of his assigned duties, and/or (b) provides him with a new, different or additional knowledge or skill necessary for the maximum development of his potential abilities with respect to the field of his work within the company.

Upward Communication

Any organization, particularly one employing professional personnel, functions best when each individual has maximum access to the thinking of his superiors, as well as of his subordinates, in the organizational structure. In many organizations the vertical communication is restricted to a downward flow. Upward flow of information is often stifled for one or more reasons. Sometimes there is natural reticence at the lower levels of a large organization. Sometimes there is jealousy on the part of subordinates. Sometimes there is general conservatism among young professionals who feel that expressing their opinions to their superiors may be misunderstood by senior personnel. Sometimes there is lack of a convenient mechanism to carry the information upward. For whatever cause, serious impediments to the upward flow of communication often exist. Organizations have established various devices to promote the flow of information upward.

Recognition

Recognition is attention and status given to an individual for job accomplishment. For the scientist and the engineer, the accomplishment is generally significant to the mission of the individual's organization or to the skills or knowledge of a profession or both. The accomplishment may represent individual effort or group effort. Equitable recognition means that the company or agency or institutional recognition plan is administered on a basis fair and just to all in the group covered by the program. A program of equitable recognition for scientists and engineers is an essential to retain such personnel and to develop maximum potential of scientific and engineering staff. Companies have reported several types of recognition particularly applicable to professional employees. Such types may be classified, basically, as monetary or nonmonetary. . . .

We believe that through the utilization conference program significant progress has been made, and will continue to be made, in a realistic way to improve the conservation of scientific and engineering manpower.—**End.**

The three previous papers were presented at a combined meeting of industry and education groups during the National Society's annual meeting in New York City.

Starting on the next page are three papers given at a panel discussion on "The Merging Role of Engineering and Science." ►

The Merging Role of Engineering and Science

By

JAMES F. FAIRMAN, P.E.

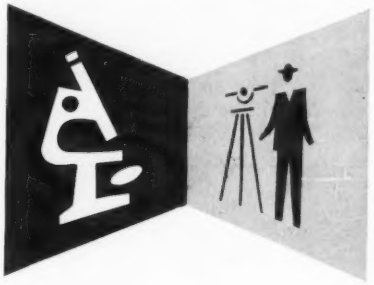
Senior Vice President, Consolidated Edison Co. of New York, Inc.

JAMES CLERK-MAXWELL, the 19th century physicist, is quoted as saying. "It is the universal condition of the enjoyable that the mind must believe in the existence of a law and yet have a mystery to move in." Applying this to the subject, "The Merging Role of Engineering and Science," one might say the engineer gets greater enjoyment from his application of established physical laws, while the scientist derives more pleasure from delving into the mysteries of unknown laws. This does not deny a relationship between the two. It does serve to differentiate them.

The phrasing of this subject assumes the partial obliteration of this distinction between engineering and science in today's industry and education. The experience of my company in the last few years with the design and construction of a nuclear electric generating station provides some basis for believing the assumption has merit. We and others in the utility business found ourselves in 1954 with some theoretical knowledge, but very little practical engineering analysis of nuclear power generation when the Atomic Energy Act of 1954 opened the door for us to this new field.

Not only was the door opened, but we were shoved through it by the urgency of national policy. Today, a few are sadder, and all are older and wiser as a result of our exposure to the uncertainties this side of the door.

This pilgrim has found the progress in these short five years almost as exciting as the progress of John Bunyan's allegorical traveler. Much of the stimulation comes, I am sure, from engineering which presses so closely to the frontiers of science. Sometimes, indeed, the engineers need answers to questions the scientists have not yet solved. Our engineers work with the engineers and scientists of our nuclear designer and consultant in a joint effort to remove or at least to reduce the mysteries.



This intimate working relationship between those who seek general laws and those who must give them economic application is relatively rare in the utility industry. Even at the very beginning of the electrical industry, the principles of direct current generation and distribution only required application. There was a fifty-year lag between Ohm's statement of his law and its application to the development of the incandescent lamp.

The history of the electrical industry might have been far different if its development had resulted from a period of forced growth. Imagine if you will that electricity from Faraday's crude generator had had some great potential for war in 1831. Suppose that in 1841 a great war had broken out and a secret Manhattan Project set up to exploit the destructive force of electricity. Only a few knew of this new power and they could only dream of peacetime uses Finally the war ends, national security relaxes in 1854, and national policy requires immediate construction of giant electric generating stations capable of serving great cities.

We know this did not happen. Yet the start of the nuclear power industry did happen in almost this way. Nuclear scientists and utility engineers have been combing neutrons and mills per kilowatt hour out of each other's hair ever since.

This new working relationship is not limited to unclear power but this is the field with which I am most familiar. I think it is within my prerogative, however, to state in passing that war and its aftermath did much to stimulate this new relationship. The "project" organization used by many industries in their attack on engineering problems developed during the war. Each "project manager" rides herd on scientists, engineers, designers and draftsmen in pursuit of a single goal.

We still live in the shadow of war. It is legitimate to ask whether the merging role of engineering and science will in time become divergent again. Will the physical laws in nuclear or solid state physics become so well established that engineers can return to their first love—and the scientists to theirs?

Or have modern industrial societies reached a point technologically and culturally where they will demand that engineering and science continue a close working relationship? The increasing amounts of money being spent on research by business and industry in all fields suggest that the merger is here to stay.

Such a development has implications for scientists and engineers, for the companies that employ them, and for the institutions that educate them. It would be unhealthy if we should stifle in school or in industry those great minds which give us creative insights of the world of nature. The pure scientists cannot be allowed to disappear or be shackled as a result of our desire or need for faster technological progress.

The contributions of scientists and engineers, working as a team,

to our national welfare have forced them into the spotlight of public opinion. Our responsibilities are correspondingly broadened. It is increasingly necessary that our educational institutions provide a broad cultural base for the technically trained. We must, more than ever, be aware of and have an appreciation for those values outside of science and engineering.

As the role of the scientists and engineer merge, each will have to extend his field of vision and areas of knowledge. The physicist who understands the nuclear requirements of a reactor core and the engineer who knows the structural and mechanical requirements of operating conditions are equally essential to the development of core design. Each must have a thorough understanding of the other's problems.

On the professional side, the pure scientists who enters the industrial world will be learning a new discipline—the discipline of economic analysis. Without diminishing the appeal of knowledge for knowledge's sake, the scientist will find a new spur from answering questions that will have immediate social and economic value.

The challenge of the merging role is particurlarly acute for the professional engineer. He is still charged with the design of economic applications of scientific laws. The closer he works to the frontiers of science the more exacting are the standards he must set for himself. In nuclear power, as in other advanced areas, a body of experience does not yet exist on which to base predictions of performance. For experience the engineer must substitute mathematical analysis. A good many practicing professional engineers are using mathematical tools they haven't used since college and are learning to handle some new ones.

A broader range of knowledge, more exacting professional standards, new types of work organizations, greater social responsibilities —these are some of the implications of the merging role of engineering and science.—**End.**

The Merging Role of Engineering and Science in Industry

By

CLARENCE H. LINDER, P.E.

Vice President, General Electric Co.

I SHOULD like to take as a sort of text an epigram of G. K. Chesterton's. He was on occasion moved to challenge the school of thought which advocates "plain living and high thinking;" and he did so by saying he often thought more good might come of some plain thinking and high living. Certainly we are living high today; and the important question is "Are we doing enough plain thinking about how it came about and how to extend and continue its benefits?"

I am, of course, referring to the economic implications of the phrase "high living," as measured by unprecedented levels of production and consumption, and to the social implications of our startling scientific and technological achievements—of which the present level of our economy is but one tangible result. My concern is with a noticeable absence of plain thinking about science and technology; a condition which is evidenced by the great confusion of tongues we hear speaking within the scientific and technological community, as well as outside it. You have only to listen or read to find words and phrases such as "research," "engineering," "basic," "pure," and "applied," being bandied about in a fashion which no one could be blamed for calling confused. Usage and meaning differ sharply even within given contexts such as the schools, or industry, or private institutions, or government; and, of course differences between contexts are almost an accepted fact of life.

Naturally, the question arises whether there is really much urgency in the matter. In spite of the muddled, ambiguous terminology we use to describe and define our efforts, we have produced some astounding results to date. Can we not continue to do so? I think many of use feel the chances of successful muddling for the future grow slimmer every day—and the dangers greater. Why? Because science and technology do in fact occupy such a key position in our society today.

In the materialistic view, we have built upon science and technology a towering complex economic structure; we have also awakened competitive economic drives in quarters of the globe where they were for centuries not known; finally, we have invoked some terrifying science and technology guardians of a precarious peace. In the philosophic view, our scale of values may be said to have become heavily weighted toward being "first with the most" in terms of apparatus and products—from space vehicles to mink-trimmed telephones.

We cannot, however, escape the fact that growth and progress in science and technology are increasingly costly of our effort and resources—particularly our resources of competence. This country is coming to see that its resources are not unlimited; consequently the focus and effectiveness of scientific and technological effort are becoming fully as important as the results achieved. We in the community of science and technology will certainly be audited—not only by our peers, but by the public as well. Understanding of our goals by the public, as well as among the experts who accomplish and direct the work, may indeed be the measure by which we succeed or fail in the long run.

It is, I think, this concern with the wise use of our resources which prompts so many people to speak out with regard to science and technology today. Their concern is an absolutely vital one, and it is most unfortunate that the loose, ambiguous terminology available to them serve their cause so poorly. It seems inevitable that no trenchant point or valuable suggestion can be offered without provoking either strong disagreement or a storm of emotion with respect not to the point itself—but to the terms in which it is stated! It is small wonder that action waits while the chorus rises in volume and emotion.

Recently, I have had some experiences which were very much in point. First, I listened to some speeches in which the following implications were clear and strong:

- Scientists are those who limit themselves strictly to abstract ideas.
- Such "pure" science requires a higher order of intellectual equipment than any other activity.
- Scientists in this sense should be provided with the means of living and working; with isolation; and, if you please, with freedom from audit.
- If the faintest whisper of the word "application" comes in at the door, dedication and intellectual content fly out the window, leaving behind something which is no longer worthy of the name "science."

Would you say there were some points of controversy there? Sure enough, on a later occasion I heard another speaker deliver a spirited retort to most of those points. He asserted that the scientist cannot abrogate responsibility to his fellow man and that work undertaken out of a desire to benefit mankind is not, *ipso facto,* less deserving of intellectual respect and effort. The speaker also put himself resolutely on record—to my personal satisfaction, I admit—that there are not two kinds of science, "pure" and "applied," but rather ". . . science and its applications."

Of course, there is not one of these statements I have just summarized which does not contain elements each of us would agree with. On the other hand, there is not one of them which could not be challenged—with the usual mixture of fact and emotion. What can the trouble be? Dr. Merle Tuve, speaking at the public forum which Dr. Warren Weaver organized for the Sloan Foundation in New York this year, made these points which, in my opinion, describe our difficulty very aptly:

"We all know," he said, "what

we mean by truly basic research. We mean a devoted and almost passionate personal activity in search of new knowledge, not just factual information, but knowledge of the kind which can enlarge our understanding, knowledge which is not facts in isolation but facts related to guiding hypotheses or principles, knowledge which relates to natural law. . . ."

". . . I would like to point out," he continued, "that all of us (scientists) have contributed to a more or less purposeful confusion in our use of the words 'basic research.' We have lumped under 'research and development' so many huge technological activities in the national budget, and correspondingly in corporation budgets and elsewhere, that the figures have become practically meaningless. . . ."

". . . After the special usefulness in war technology of men trained in basic physical sciences had been demonstrated during World War II, the idea of *mission-directed basic research* was firmly implanted. . . . We have all been faithfully supervising the growth of this hybrid notion ever since, in the halls of Congress and in the minds of the public."

(Even in this excellent statement, note that Dr. Tuve does not rely on the term "basic research" alone, but feels obliged to go one step further to "truly basic research" in order to pin down his meaning).

Along the lines of Dr. Tuve's remarks, I would suggest that our complex tangle of difficulties stems from three main causes:

1. Lack of effective classifications of scientific and technological work.
2. Differences of viewpoint between those doing various categories of work and those outside their category.
3. Lack of experience in recognizing special combinations of work —and people—which may be needed from time to time.

I proposed now to offer in condensed form some concepts and terminology which have been developed in the company I am associated with. They were developed for precisely the reason that focus and effectiveness of effort must be of prime concern to a business or industrial organization; and I can say to you from experience that we were convinced we could not attain requisite focus and effectiveness in scientific and technological effort unless we clarified our thinking and our terminology. The material is now being used and evaluated in our organization, and I offer it for its possible usefulness to others, recognizing of course that modifications may be needed to fit specific cases.

As a starting generalization it may be said that scientific and technological effort deal with information. The great existing funds of information may be said to be of four quite distinct kinds:

Understanding—the deep, orderly comprehension of natural phenomena which is reflected in systematic, precise descriptions and in formulations of physical laws that have the power to correlate past observations and predict future observations in broad categories of nature. (Understanding is thus characterized by unifying ideas, such as Newton's mechanics, or Einstein's relativity theory.)

Knowledge—the systematized body of facts about nature, the relationships between which may be known only empirically. (In knowledge, the basic entities, forces and processes which give rise to known characteristic relationships are not necessarily understood.)

Technology—the technically proved concepts and practices for

applying—especially by using the scientific attitude and method—understanding and knowledge of nature for specific purposes. The concepts chosen for any particular application usually embrace understanding and knowledge from a number of branches of science. (Technology thus embodies the history of successful experience of this kind in various fields, and is usually recorded.)

Lore—the empirical attitude, approach, information, method and technique gained through an individual's experience. (Lore tends to be unsystematized, and usually does not exist in recorded form.)

THUS, understanding, knowledge, technology and lore constitute the great funds of information, with understanding and knowledge making up what is generally termed the body of science. (I should like to note here that these classifications were intended to be generally applicable, although they were developed out of the experience of a particular enterprise. For instance, if you include in, or add to, the idea of "nature" the physical attributes of man, such fields as medical science and technology fall into place. If you choose to include or add the behavioral attributes of man, the so-called "inexact sciences" will be included. Please note also that Dr. Tuve's distinction between unifying concepts or hypotheses and bodies of fact is amplified and, I hope, put in acceptable perspective.)

These descriptions of the funds of information offer a background against which to examine what takes place within the scientific and technological community. From such an examination there emerged in our case three observations which offered us valuable guidance.

First is the quite familiar observation that many people within the scientific and technological community are engaged in the *same activities*—notably use of the scientific method—with respect to the *same subjects;* for example, studying the behavior of light, or building technical apparatus. This strongly suggests that we shall never escape confusion if we persist in the widespread tendency to classify people and their effort in terms of activities and subjects. Isn't it, for example, a generalized classification by subject we are attempting when we say—rather loosely—that "pure" scientists are distinguished by their dealing with abstract ideas—as if no one else ever formulated or used a concept? And surely it is this kind of thinking and speaking which produced the image of the scientist among high school students reported by Dr. Margaret Mead and Dr. Rhoda Métraux: "The scientist is a man who wears a white coat and works in a laboratory."

The second observation was that the subjects to which particular groups of people direct their activities very often embrace a number of related branches of both science and technology. This second observation suggested to us that we should do well to avoid any classification scheme or terminology which implies that either science or technology is exclusively the interest of any particular group.

The third observation was that the results of people's effort in science and technology will fall into two general classifications—irrespective of what activities and what subjects are involved. The results will either be:

1. New information to be added to the total funds; or

2. New physical entities which are applications from the funds, made to meet human needs and wants.

This observation, consequently, did suggest a workable way of classifying scientific and technological effort; namely, by means of the primary objective toward which the effort is exerted. In the broadest terms, then, the two distinguishing objectives would be "learning about nature" and "applying." Worked out in detail for our purposes, the classifications are as follows:

We call *scientific research* that work whose primary objective is to obtain and communicate new understanding and knowledge of nature; that is, to add to the body of science.

WE call that work *engineering* whose primary objective is to apply science plus experience (technology and lore) to meet requirements and conditions derived from human needs and wants.

(Here again I would ask you to note the possibility of general application of the termiology. The term "engineering" is appropriate for work which primarily seeks to apply science, technology and lore to design an entity which will meet human needs and wants. I have no parallel term to suggest for other fields such as medicine, for instance. But I suggest that the distinction holds for all fields; that is, among all the welter of common activities and subjects, we can always distinguish between those whose end objective is a piece of learning—something written on paper or carried in the mind—and those whose end objective is a design for a physical entity—whether it be a new molecule, a new material, a new drug, a new process or procedure, or a new apparatus.)

Of course, condensed statements such as these invite and require deeper consideration of the implications they contain. I should like, therefore, to amplify one salient point about these descriptions of scientific research and of engineering. Note that the division is by primary objective; but other objectives are not ruled out. This permits reconciliation with some highly significant observed characteristics of work in research and engineering. First, in the conduct of scientific research—

(1) Technology and lore are often employed;

(2) "By-product" applications often have to be designed, made and used (for example, special instrumentation);

(3) Those applications often suggest new or better ways and means of satisfying human needs and wants;

(4) Additions to the funds of technology are often made—*all* in pursuit of the *primary objective* of learning about nature.

Similarly, in the conduct of engineering—

(1) A number of branches of science and related technologies may be involved in the design and construction of a physical entity to meet human needs and wants;

(2) Work to gain specialized new knowledge of nature may be necessary as a by-product, and the

results may indeed constitute additions to the body of science;

(3) The final designs are themselves information, and add to the funds of technology.

Thus in the broad familiar terms, scientific research may be said to be concerned with learning about nature; engineering with applying to satisfy needs and wants of people. By the primary objectives of their work, research builds the body of science; engineering—in order to produce good designs efficiently—builds the funds of technology; and both add to lore.

WITH the basic distinction between scientific research and engineering established, it becomes convenient to examine each of them to identify, if possible, any significant differences within "scientific research" or within "engineering" as described above. It is easy to think of a great many possible examples of variants to be found in everyday experience, but, if we stick to classification by prime objective of the work, these examples sift down into four classifications—two for research and two for engineering. No familiar terminology is at hand to supply an appropriate name for these classifications, and so the simple nomenclature of Categories I, II, III, and IV has been adopted, as follows:

Category I (engineering) includes all work whose prime objective is to provide new or improved designs to satisfy human needs and wants; designs which embody ways and means which have been proved to be technically feasible. (The word "design" is used here to provide generality in the statement; the design may be for a product, or a process, or a material, etc.)

Category II (engineering) includes all work whose prime objective is (1) to provide ways and means of making new or improved designs, and (2) to demonstrate that these ways and means are technically feasible.

Thus, people working in both these engineering categories (1) apply understanding and knowledge of nature plus experience (technology and lore), and (2) are concerned with new or improved: design criteria and processes, methods and techniques of designing; design features and characteristics, and design themselves.

But note that the people in each category are aiming at very different objectives. Those in Category II are concerned first with conceiving and developing ways and means of producing the designs and then, equally importantly, with demonstrating that these ways and means are technically feasible. But for those in Category I, technical feasibility has already been established, and they are concerned with conceiving, producing and communicating the specific designs that will satisfy the requirements and conditions derived from needs and wants of people.

Category III (scientific research) includes all work whose prime objective is obtaining and systematically presenting new scientific knowledge of nature. Included in Category III is such work as observing new natural phenomena, and systematically measuring and presenting data on observed properties.

Category IV (scientific research) includes all work whose prime objective is developing and describing scientific understanding of nature. Included here is such work as seeking to postulate concepts which will correlate and predict observations of natural phenomena; and seeking to generate, and describe abstract (mathematical) systems such as the calculus.

Once the distinction between scientific research and engineering plus their subdivision into the four categories has been made on the basis of objective of the work, we are in a position to clear up our thinking and communication in a number of areas. I should like to demonstrate some of the results, as extended examples, so to speak.

IF we lay out the work of the scientific and technological community by the four categories, we gain some insight into the sources of emotion about the intellectual content of work. We can see that each category may contain work of various levels of abstraction and people of varying degrees of competence. We can, for example, place the ratiocination of Einstein in Category IV and the long, painstaking observations of Mendel in Category III. We need not set one above the other; we need only to recognize the basic drive to learn which they shared and the inestimable worth of both.

The categories also provide insight into some important areas which concern focus and direction of effort. They highlight differences in the competence and interests of people required for each category of work, and help us make more objective appraisals of relative scarcity, in the light of current and future needs. They underscore the fact that the physical resources and facilities needed are primarily a function of the problem, rather than the categories. They also remind us forcibly of inherent differences in the timing and measurement of results between, say Category IV and Category I.

The four-part classification also, I would say, offers a clearer basis for judging the magnitude and proportion of total effort. . . .

I would hope, too, that we might gain perspective on the matter of feedback, seeing it perhaps as a communication among the categories. In this view there would be no confusion on the need for a guiding concept to be present before experiments are planned, costly facilities erected, masses of data gathered, or elaborate apparatus built. At the same time, however, the category classification would remind us that controlling ideas occur in two contexts: not only for the enrichment of understanding and knowledge, but also for the syntheses of designs. Thus original thought—with all its valuable connotations—is needed and may be expected to occur in every category. Our concern should be to encourage it everywhere, and further the exchange of information among original thinkers, wherever they are working.

I believe that an analysis such as we have been considering can also help us disentangle some of our problems of composite viewpoints and objectives. The category classifications state the primary technical objective of the work itself. That is, they describe the results which are *sought* by the person doing the work, and they describe the results which can be

expected from the work by those having an external relationship to the work.

To the extent we find in practice the theoretical case of the individual worker dedicated solely to his work, his is the only objective, and his the only viewpoint we need to reckon with. In practice today, however, a very great deal of research and engineering work are carried on within the context of over-all objectives which include the technical objective of the work, but involve other considerations as well. In my connotation, we call them business objectives—profit is certainly the most famous one. For the schools, I suppose we could call "education" such an over-all objective. Government has "defense" and many others. Then there are the over-all objectives toward which specific projects are directed, such as curing disease. In view of this composite nature of many of our objectives, it is essential to keep two points in mind.

First, the over-all objectives may, or may not, be of active interest and concern to people doing research and engineering. If we assume that they are when in fact they are not, we get an immediate clash of viewpoint.

Consider the case of a university, with its over-all objective of conducting day-to-day educational programs. Certainly there are on the campus people engaged in both research and engineering with whom the objectives of day-to-day classroom effort are very real and highly influential. Yet there are also people—and they achieve valuable results—to whom the technical objective of their work is absolutely paramount, and only coincides with the over-all objective of the classroom in the cases of a very few special students.

The case of a business enterprise is somewhat parallel. A business may have a number of over-all objectives in view; certainly all its work must fit within the over-all objective of profit. Yet the business objective of profit certainly does not rule out the outstanding individual who concentrates entirely on the technical objective of his work. Nor, to my mind, is his work in any way diminished or tarnished by reason of being undertaken within the business context of profit. Genuine contributions to the body of science, and outstanding engineering achievements, are in fact made within that context.

Second, it is essential not to confuse primary technical objectives with over-all objectives. This is particularly important in view of the increasing necessity today to conduct scientific and technological work on a project basis, in which people of diverse competence, working in various categories, contribute to an over-all result. If then, we confuse the over-all objective with the primary technical objectives of these various pieces of work, we may indeed not know whether we are doing research or engineering. Equally important, we may not attain the proper balance of work needed in each category.

For example, the end result of a program to cure cancer will be an application, of course; that is, a process or a material applicable to human need. But we know full well that within the project there must be not only application work in Categories I and II, but also learning work in Categories III and IV. The point is, when we are planning, conducting and measuring pieces of work, we must bear in mind the objective of the work, as distinguished from the objective of the project.

As my last item, consider the implications of analyzing work by its objectives upon the question of "Who is a scientist and who is an engineer?" I would submit that the objectives we have stated for research and engineering coincide well with what we generally observe to be the basic characteristics of scientists and engineers: subject orientation and dedication to learning for the one; a passion to invent or improve physical entities for the other. I believe, too, that the objectives stated indicate the conditions under which the scientist and engineer find it most natural and comfortable to work; for the scientist, primary commitment to the demands of his subject and field of interest; for the engineer, deep commitment to needs and wants of people.

However, we must recognize that people do in fact today cross over, changing their interests either temporarily or permanently. It is evidenced, for example, by the fact that we have physicists today designing nuclear reactors. It reached its peak, perhaps, during World War II in the great expansion of "mission-directed" projects, to use Dr. Tuve's excellent phrase again.

I would suggest, therefore, that when we describe engineers and scientists, we give consideration to the technical objective toward which a man works—as well as to his formal training. If a person works predominantly in Categories III and IV and makes contributions of suitable stature there, should we not call him a scientist? If a person works predominantly in Category I or II and makes contributions of suitable stature, should we not call him an engineer? At least, let us remember that if a man does cross over, he must expect to accept the objectives and conditions of his new category.

May I also say, in passing, that I think it is our need for project organization structures and the prevalence of cross-overs which give rise to the idea of merging roles of science and engineering which is the theme of this discussion today? I would not say the roles are merging. Indeed, on the basis of technical objectives of the work and interests of the people who do it, I would say the roles cannot merge. What can and does happen is that the scientist and engineer work more closely together within the framework of given projects, and both may indeed from time to time undertake work toward objectives of each of the categories. I see good, not harm, in this, provided we recognize it as a special case arising from special needs, and not regard it either as definitive or as a condition to be corrected. Society judges our work in terms of results; and in the complexity of science and technology today, the organization structure which will attain results is the structure to have—whether it is one man, or a hundred. The essential point is that we ourselves understand and be able to describe clearly the technical objectives and the over-all objectives which may be involved—

regardless of who is doing what at a particular moment.

I might also have the temerity to suggest something like the categories as an approach to untangling some of the relationships in our learned societies. We now have within the engineering community, not only the founder societies, but new groups forming almost literally by a fission process. Is this necessary; is it good? Clearly, in all these groups we have great areas of common activities and subjects. Is there, then, sufficient difference of objective between them to justify so many? More important still, will the objectives we seek be attained by many competitive agencies working in parallel? Perhaps, for example, an analysis such as the one I have offered might help us distinguish between organizations whose objective is the exchange of specialized information and organizations whose objective is the setting of standards and the furtherance of professional status.—**End.**

The Merging Role of Engineering and Science in Education

By

JOHN C. CALHOUN, JR., P.E.

Vice President for Engineering, Texas A&M College

No one will deny that science and engineering have a tremendous impact upon our way of life and upon the development of our civilization. From the top professional man and public servant to the individual man in the street there is an increasing awareness of the permeation of scientific events throughout the general fabric of current history. The public daily reads of the political and economic impact of guided missiles, nuclear energy, and space travel; it views the effects of these advances through the equally important technological medium of TV, and accepts routinely each new creature comfort and convenience created by modern technology.

It is my impression that the importance of science in this developing era is emphasized more to the public mind than is the importance of engineering. Engineering is played down in most descriptions of current events. The tenor seems to be that science has provided the impetus, the know-how, and the key to advances. When engineering is mentioned, it is likely to be as a poor cousin of science. As an engineer, I have questioned the lack of emphasis on the importance of engineering on the national scene and am, therefore, pleased to see that the National Society for Professional Engineers is undertaking to discuss the merging role of science and engineering.

What is the basic relationship between science and engineering. What do we mean by a "merger" of the roles of science and engineering? Does each have a distinct role and function? Have these functions been more unique in the past than they are now? These are some of the questions that come to mind as I approach this subject. The statement of the title in itself suggests a conclusion that there is a merging role. Is this conclusion warranted?

As I see the question, both engineering and science have performed distinct functions in the technological growth of civilization. They have always worked together as a team toward the common goal of improving the welfare of man. Now, however, certain evolutions of our system of technology have emphasized this team work. We seem to be aware of a new relationship. To draw an analogy, the many years of keeping steady company have finally seemed to have led to marriage.

The entire picture is confused even more because of trends which seem to indicate that not only are science and engineering becoming closer partners but that they are becoming identical. My thesis is that the merging is apparent, not real; that although married into a team, each retains its individual characteristics and unique functions; and that the maintenance of individual identity is of fundamental importance to the continued development of our technological position, a fact which is recognized in our engineering educational programs.

I would like first to examine the differences between engineering and science. These differences are not clear-cut. After all, science and engineering are interested in the same physical laws, work with the same kind of tools, and talk much the same language. How, then, do they differ?

The facts are that engineering is rooted in and based upon science, and that science in return makes use of the tools and fruits of engineering for furthering its own role. In the organic tree of technology the survival of each is necessary to the survival of the other. Science desires the understanding of the physical universe and the natural laws which control it; it thrives upon investigation into the universe for the sake of the knowledge itself. Science seeks the attainment of "why." Engineering, on the other hand, starts with the scientific facts and phenomena that have been uncovered within a particular physical situation and directs them to meet at particular purpose of man. It thrives upon the use of the natural laws. It seeks the attainment of "how."

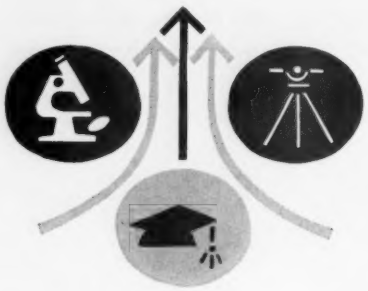
An analogy from another professional field many assist in clarifying the difference I am trying to elucidate. The scientists in medicine might be interested, as an example, in diseases of the heart. This is a very general subject involving all hearts and all evidences of heart disease. His objective is to know all these diseases in all hearts and to understand why all

such cases occur. The practicing physician, on the other hand, performing a function analogous to that of the engineer, is called upon to deal with a specific case of heart disease in a specific man. His function at this point may require knowing many details of heart diseases, but his particular objective is to understand how the condition which he finds may be alleviated in the specific instance in which he finds it. To accomplish his objective, he needs to take into consideration everything he knows about the man, himself, as well as everything he knows about heart disease.

SOMETIMES the "how" of a situation may be learned before "why." Indeed, the knowledge of "how" may give rise to the searching for "why." At other times the reverse may be true—a knowledge of causes may lead to the accomplishment of an application for a particular purpose. It may seem ideal to know "why" first; yet there are many situations in which by accident or otherwise it is easier to invent the "how" before the "why" is known. The important point is that there exists a fundamental tie between the two. Engineering's roots in science lead to the result that engineering will advance as science advances. Conversely, any great advances in engineering must also be accompanied by advances in science. To the degree that these two elements can be brought into balance and developed simultaneously, one can say that the scientific and engineering functions have been merged.

The fabric of technology, then, is in part made up of a basic relationship between the distinct and different roles of science and engineering. Woven into this fabric, however, are several strands which seem to obscure these basic relationships. The strands of interest involve the natural evolution of both science and engineering. Let me cite a few.

First, there is the growing complexity of scientific knowledge. This, in turn, means that the roots of engineering become more complex, and it becomes necessary to broaden the base of engineering. At one time, for example, engineering education was considered sufficient if the science courses covered only physics. There was no particular concern for courses in chemistry. Today, all recognized engineering curricula have courses in chemistry, and some engineering educators think all engineering students should take physical chemistry, a course previously con-



sidered to be far beyond the engineer's usefulness. We are probably not far from the day when it will also be considered necessary for engineering students to have basic courses in the life sciences.

To the degree that the scientific base is broadened, and more time is spent on the basic sciences for educating the embryonic engineer, we may say that the educational program merges science and engineering. However, I prefer to consider the relationship that of presenting those scientific concepts which the engineer will be called upon to use later.

Second, science itself moves forward. In a very real sense the engineering of today is the science of yesterday, and so long as one can see a reasonable time lag, a definite distinction of function is recognized. Because the tempo of each has speeded up, and the time lag has lessened, science and engineering may have seemed to merge. For example, the engineering development and use of the transistor are removed much less in time from the underlying scientific concepts than the electric motor was removed from the basic scientific concepts pertaining thereto. Indeed, in today's laboratory one may move all the way from the birth of a scientific concept to an engineering application in one short period of time or as one continuous operation. This compression of the time scale can be interpreted as a merging of science and engineering.

As the frontiers of science move, the scientist also abandons certain classical concepts, which the engineer must retain. In this sense, engineering may seem to become more like science. Examples of this retention are found in the engineering sciences such as thermodynamics, electrical theory, fluid mechanics, and chemical kinetics. Often the engineer's criticism of the physicist and the chemist is that they do not wish to deal with classical physics and chemistry, but rather with modern physics and chemistry. This criticism is not really justified. It is only natural that the scientist's interest will be at the frontier of ideas. Delineation of the details, and the refinements that arise from applications, therefore, fall into the engineer's lap, and, indeed, are parts of his function. In transferring these things to his domain, the engineer may seem today to be more of a scientist than he was yesterday. He is, however, no more a scientist than he was before. He has taken over some of the scientist's tools and is using the concepts which the scientist no longer finds invigorating.

Third, engineering also is advancing conceptually. Engineering of the past has been largely an empirical proposition. Although it will aways be somewhat empirical, it has reached the stage where engineering facts and practices have become a sufficient body of knowledge to permit correlation and coherent treatment from a theoretical point of view. Any activity becomes more scientific as its attributes becomes known well enough to be treated theoretically. The evolution of a theory involves logical processes, the formation of concepts which need to be tested and tried, the statement of correlations which can be expressed analytically, and the testing of theory against fact. This involvement may be called the scientific method, and one can say that engineering is becoming a science in this sense that it uses this method.

THE question of the existence of engineering theory has been pondered by many engineering educators. It is my opinion that we have lacked real engineering graduate study because we have not had engineering theory at our disposal. Graduate work in engineering has relied a great deal upon scientific theory and scientific advances. For the most part, our graduate work in engineering has really been a deeper delving into the sciences underlying engineering or the details of a scientific area necessary to a particular application.

What is engineering theory? There seems to be an embryonic theory of engineering in such fields as operations research, communication theory, systems applications, and in some of the more advanced environmental problems. To the degree that this theory develops and becomes analytical in nature, one may conclude that engineering must merge with science. However, I suggest the alternate possibility that as theory evolves, it will show more distinctly the divergence of science and engineering.

Fourth, engineering is also becoming more complex. Engineering today encompasses what are usually known as engineering systems. In the past concern was generally linked to an engineering problem. Groups of engineering problems which must be solved simultaneously are engineering systems. Such systems necessitate teamwork between scientists and engineers. In fact, other professionals may also be members of the team assembled to achieve the best over-all solution to a system. This concept is well illustrated in nuclear systems, aircraft systems, computing systems, and missile systems, to name only a few. . . .

Fifth, a knowledge of the environmental sciences if of growing importance to engineeering projects. Environments of particular current interest are the ocean, the atmosphere, the polar regions, and outer space. Each has its own particular boundary conditions, and, therefore, an evaluation of the particular physical constants which apply and the solution to analytical equations for the environment are required before engineering can succeed. As an example, for engineering practices within the rock mantle of the earth, as in my own field of petroleum engineering, the laws of science that are involved are often those of classic physics as, for example, fluid mechanics. The conditions encountered, however, are fluid flow through fine interstices in a rock matrix involving non-miscible fluids. These conditions define the environmental problem. Such science-oriented environment problems represent a borderline between the basic sciences of physics and chemistry and the attainment of an engineering application. As man probes his universe more deeply, it becomes more and more important for him to delineate and analyze these borderline subenvironmental behaviors before the engineering can proceed. . . .

NOW, I would like to relate these ideas to trends in engineering education. A good idea of these events is evident if you have followed the activities of the American Society for Engineering Education or the Engineers' Council for Professional Development over the last ten to twelve years. The ASEE has issued a series of reports, based on long study, chief of which was a 1953 report entitled "An Evaluation of Engineering Education." Other reports since that time have implemented this first and basic report. The ECPD has used this study for many of its policies in carrying forward its accrediting work for engineering curricula.

The basic role of science in engineering education has been fully recognized. The present ECPD criteria for engineering curricula suggests a minimum of one year in the basic sciences and mathematics, about equally divided. Generally speaking, the basic sciences are interpreted to mean physics and chemistry. Mathematics is presumed to be offered at least through the calculus, and, if possible, through differential equations. More advanced curricula, of course, go further in mathematics.

The ECPD criteria call for a minimum of a year of the engineering sciences. In the case of a curriculum that is strongly reliant upon environmental study, such as petroleum engineering or agricultural engineering, the suggested year of engineering sciences can include environmental sciences also. These are the subjects, referred to previously, which bridge the gap between the basic sciences and their application, which represent the beginning of engineering applications, and which give the engineer the behavioral aspects of the basic sciences within a given set of boundary conditions peculiar to the special environment within which his practice occurs.

The criteria for an engineering curriculum also enumerate qualifications in the humanistic-social sciences area, ranging from one-half to one year, depending upon one's definition of the humanities and social sciences. They also specify courses in design and analysis of engineering systems; and finally, they envision a coordinated program, so that the engineering analysis and design can make maximum use of the basic sciences, engineering sciences, and mathematics which are included in the curriculum.

In other words, the standards for engineering education of today recognize these facts: (1) that engineering is rooted in science; (2) that there is a borderline area between science and engineering, which is condensing into a recognizable entity known as "engineering science," and (3) that there are involved systems to which the elements of engineerig theory can be directed. The engineering curriculum is not designed to produce a scientist, but to produce an engineer. For this reason a definite amount of engineering analysis and design is specified. To plan an engineering curriculum that will qualify for accrediting, one must recognize that differences exist between the roles of the scientist and the engineer. The education of the embryonic engineer must prepare for these differences.

There is, of course, a great debate current among engineering educators on this subject. There

(Continued on page 63)

Strictly Business

Personalities . . . **A. W. Peabody** has been appointed supervising engineer of the corrision engineering group of **Ebasco Services Incorporated,** it has been announced by **W. H. Colquhoun**, vice president in charge of engineering . . . **John C. King** has been named product development engineer for the **Master Builders Company,** Cleveland, Ohio . . . **James H. Bower** has been appointed head sanitary engineer with **Patchen, Mingledorff and Williams,** consulting engineers, of Augusta and Atlanta, Ga. . . . The appointment of **Bruce M. Smith** as chief industrial engineer for **SKF Industries, Inc.,** Philadelphia, Pa., has been announced . . . **A. E. Diehl,** project engineer for the York, Pa., Division of **Borg-Warner Corporation,** has been named assistant manager of the Division's Hartley plant in York . . . **Graham B. Knight** has announced the formation of **Advanced Technology Associates** in San Antonio, Tex. . . . **I. O. Johnson** has been appointed director of industrial and production engineering by the Fulton Sylphon Division, **Robertshaw-Fulton Controls Company,** Knoxville, Tenn. . . . **Parker Seal Company,** Culver City, Calif., has appointed **Ted J. Carrell** to the position of engineering manager.

Mr. Peabody

R. E. Axthelm has been named supervisor of application engineering for the **A. O. Smith Electric Motor Division**, Tipp City, Ohio . . . **E. L. Foerster, Sr.,** has opened an office as a consulting chemical engineer in Danville, Pa. . . . **Richard P. Villwock** has been appointed research engineer for **Michigan Abrasive Company,** Detroit, Mich. . . . **Harold W. Luce** has been appointed application engineer for lighting arresters in the Protection Equipment Department of **Hubbard and Company,** Chicago, Ill. . . . **Tinsley Laboratories, Inc.,** Berkeley, Calif., has appointed **James Guardia** to their design group . . . **Robert S. Kinsey** has been named director of engineering for **Electro Tec Corporation,** South Hackensack, N. J. . . . **Milton P. Barschdorf,** who recently retired as a colonel following twenty-one years of duty with the Corps of Engineers, has joined **Frederic R. Harris, Inc.,** consulting engineers, as its Lower Mississippi Valley Area representative.

Mr. Villwock

D. A. Young has been appointed chief design engineer for the Engineering Science Division of the **American Metal Products Company,** Detroit, Mich. . . . **The Perlite Institute,** New York, N. Y., has named **Richard E. Barnes** as technical director . . . **Raymond V. Burnette** has been appointed Midwestern engineering manager of the new Water and Sewage Valve Sales Unit of **Rockwell Manufacturing Company's** Meter and Valve Division, Pittsburgh, Pa. . . . **James W. Yarbrough** has recently joined the firm of **Harland Bartholomew and Associates,** and **Clark, Daily and Dietz** in Memphis, Tenn. . . . **William O. Laande** has been named liaison engineer at **Packard-Bell Electronics Corporation.** He will establish and maintain an office in Seattle, Wash. . . . The appointment of **Victor P. Kovacik** and **M. James Corbett** to new engineering management posts with the Tapco Group of **Thompson Ramo Wooldridge Inc.,** Cleveland, Ohio, has been announced. **Mr. Kovacik** has been named research requirements manager, and **Mr. Corbett** has been appointed development requirements manager . . . The appointment of **Francis G. Kirschner** as chief engineer, Acoustical Division, has been announced by **Dr. B. K. Erdoss,** president of **The Korfund Company, Inc.,** Long Island City, N. Y.

Mr. Burnette

Several personnel changes in the Engineering Department of **Minnesota Mining & Manufacturing Company** have been announced by **C. P. Pesek,** vice president for engineering and and staff manufacturing. **L. L. Morin** has been appointed engineering manager for the electrical products group; **J. H. Hiller** has been named assistant division engineer, with responsibility for the Irvington electrical division, and **Paul R. Gibson** has been named assistant division engineer, with responsibility for the magnetic products division . . . **Ross Russell** has been named manager of industrial engineering at **The Timken Roller Bearing Company,** Canton, Ohio . . . **George Hugh Tsurueka** has been appointed manager of the Housing and Cement Products Bureau of the **Portland Cement Association,** Chicago, Ill. . . . **Leonard E. A. Batz** has been named sales engineer in the Equipment Sales Department of **A.C. Spark Plug Division,** it has been announced by **Glen R. Fitzgerald,** director of sales and engineering. **Mr. Fitzgerald** has also announced that **John E. MacArthur** has been placed in charge of new ideas, new devices and patent activities in the Automotive Engineering Department.

Mr. Russell

The New Labor Law—What It Means to the Profession

ON September 14, 1959, President Eisenhower signed into law the "Labor-Management Reporting and Disclosure Act of 1959." Commonly referred to as the labor reform act, this new law is specifically aimed at eliminating the many instances of racketeering in the labor-management field as disclosed by investigations of the Senate's McClellan Committee. In addition to its reform aspects, the new law makes several significant amendments to the Taft-Hartley Act; the first major revision of that law since its passage in 1947.

Of particular concern to the National Society of Professional Engineers is the so-called "construction industry" amendment to the Taft-Hartley Act, which is contained in Section 705 of the 1959 Act. This provision permits unions and employers to enter into binding collective bargaining agreements covering employees in the construction industry, without going through the usual election procedure to select an exclusive bargaining representative. The justification for this provision arises from the fact that because of the short-term nature of most construction employment, it is not feasible to determine representatives by the normal process of a majority vote. Consequently, the new provision permits unions to speak for employees of construction contractors on the basis of agreements signed between the union and the employer. Under the new law, it is permissible for such agreements to require union membership of all covered employees after the seventh day of employment.

The concern of NSPE over this "construction industry" provision stems from the possibility that professional engineers employed by construction contractors could find themselves covered by such agreements and forced to join the union, contrary to existing procedures under Section 9 (b) (1) of the Taft-Hartley Act. That section grants professional employees the right, in all instances, to an election separate and apart from nonprofessional employees in order to determine the desire of the professionals with respect to union representation.

Although the new labor reform act does not in specific terms exempt professional employees from the "construction industry" provision, the Senate Labor Committee report on the labor reform bill passed by that body contained the following language:

"This subsection, moreover, in no way modifies other provisions of the statute with respect to special types of employees such as professional employees. Thus it is neither the intention nor effect of the bill to affect the status which professional engineers now enjoy under the statute."

And the House Labor Committee, in its report on the labor reform measure approved by that group, stated that:

"Moreover it is the intention of the Committee that the Committee bill provisions with respect to such agreements shall not be construed as modifying in any way other provisions of the National Labor Relations Act, as amended, with respect to special types of employees such as professional employees, nor is it the intention or effect of the bill to affect the status which professional engineers now enjoy under the National Labor Relations Act, as amended."

The extreme significance and importance of the above-quoted statements stem from the fact that should the question of professional voting rights arise, resort to the legislative history of the new labor reform act, as exemplified by the committee reports, will make it clear that existing rights of professional engineers remain unaffected by the construction industry amendment.

The retention of professional employee safeguards, as indicated by the legislative history of the new law, is a direct result of the combined, intensive efforts of NSPE, its affiliated state societies and chapters, and individual professional engineers throughout the country. In order to more fully appreciate the significance of this accomplishment by NSPE as a further effort in its constant and vigorous program of protecting the rights of employed professional engineers, a brief discussion of major background developments is appropriate.

85th Congress

The earliest proposal of a "construction industry" amendment to the Taft-Hartley Act appeared in a bill introduced in March, 1957, by former Senator H. Alexander Smith, (R-N.J.). The Smith bill embodied the Administration's approach for dealing with the construction industry situation and would have authorized the National Labor Relations Board to certify building trades unions as

This analysis and comment *by Stanley H. Stearman, Assistant Legislative Counsel, NSPE, and Member, District of Columbia Bar.*

exclusive bargaining representatives without a prior election. The effect of this so-called "certification without election" procedure on the rights of professional engineers was questioned by the National Society in a letter to the Secretary of Labor. A reply received from Stuart Rothman, then Solicitor of Labor and now general counsel of the NLRB, indicated that the "certification without election" proposal "is not intended to affect the present self-determination rights of professional employees provided in section 9 (b) (1). There would be no greater possibility, under the proposed amendment, of professional employees being included in a bargaining unit against their desires than there is at the present time."

A year later, Senator John Kennedy, (D.-Mass.), introduced a bill containing a similar construction industry amendment, and on the basis of correspondence with the Senator, NSPE was assured "that there would be no greater possibility under the proposed amendments for professional employees being included in a bargaining unit against their desires than there is at the present time." When the Smith and Kennedy bills, and other proposals, became the subject of hearings by a Senate Labor Subcommittee, NSPE specifically recommended that wherever reference is made to "all employees of an employer" the language be followed by "(except professional employees.)"

Out of these hearings came the Kennedy-Ives bill which departed from the "certification without election" approach and instead substituted a procedure along the lines of the "construction industry" amendment contained in the 1959 law—unions and employers would be authorized to sign collective bargaining agreements without the usual election being held. The Kennedy-Ives bill rather swiftly passed the Senate by a vote of 88 to 1. When it was referred to the House Labor Committee, NSPE once again quickly stepped into action and through contact with the members of the House Committee, pointed out that with the abandonment of the "certification without election" procedure in the Kennedy-Ives bill, previous assurances received by the Society from the Secretary of Labor and Senator Kennedy were meaningless. The Society strongly urged that the House Committee conduct extensive hearings on the bill, and conclude by either deleting the Kennedy-Ives "construction industry" amendment or amending it so that the rights of professional employees would not be impaired. NSPE efforts in this regard were strongly backed-up by affiliated state societies and chapters who provided excellent response to a request for grass-roots support. Time did not permit hearings to be held, however, and an attempt to bring the bill to the House floor under suspension of the rules, requiring a two-thirds affirmative vote, was defeated by a vote of 198 to 190. The Kennedy-Ives bill died in the House as the 85th Session concluded.

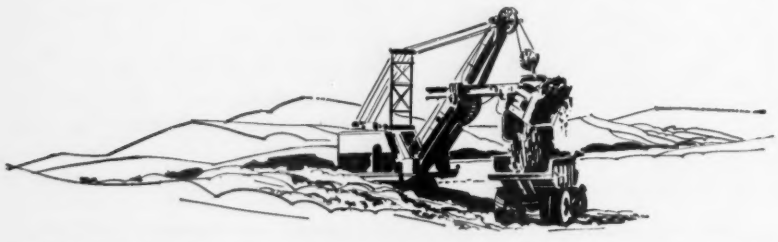
86th Congress

Early in the 86th Congress, Senator Kennedy, on behalf of himself and eleven other Senators, introduced a bill which became known as the Kennedy-Ervin bill. The Kennedy-Ervin bill was similar to the measure that failed to pass the House in the 85th Congress, and contained an identical "construction industry" provision. Meanwhile, Senator Goldwater of Arizona introduced the Administration version of a labor reform bill which, insofar as the "construction industry" amendment was concerned, provided for the "certification without election" approach as distinguished from the Kennedy-Ervin procedure. In a statement to the Senate Labor Committee, which again held lengthy hearings, NSPE urged: 1) that general Taft-Hartley amendments be divorced from labor reform legislation; 2) that if a construction industry provision is retained, the Committee adopt the procedure called for in the Administration version, and 3) that the Administration approach be further clarified to make certain that the rights of professional employees would be respected.

Once more, the Society called for a strong grass-roots campaign from state societies and chapters to convince all members of the Senate to favorably consider and support the NSPE position. The effectiveness of this combined NSPE, state society, chapter and individual engineer effort was reflected in the Senate Committee report on a "clean" Kennedy-Ervin bill approved by the Committee. Although the new bill contained a "construction industry" provision identical to the first Kennedy-Ervin proposal, the report noted that it was not intended "to affect the status which professional engineers now enjoy under the statute." After nine days of heated debate, the Kennedy-Ervin bill was passed by the Senate by a 90-to-1 vote.

While Senate consideration of the Kennedy-Ervin bill was under way, the House Labor Committee was conducting its own hearings on labor reform legislation. In testimony before the House Committee, NSPE stated that under the Kennedy-Ervin type of "construction industry" amendment, "professional employees could, and un-

(Continued on page 58)



Engineers in the construction industry were particularly concerned with the outcome of labor legislation in the 86th Congress. Language inserted in the House and Senate committee reports at the insistence of NSPE safeguarded the separate election rights of this group of engineers.

New Literature

MINIATURIZATION – Miniature Precision Bearings, Inc. is offering the 1959 Miniaturization Awards Brochure as a new piece of company literature. The brochure describes the Miniaturization Awards Competition now in progress. The award, sponsored by MPB, is presented annually to the individual or organization judged to have made the greatest contribution to the field of miniaturization. The award for 1959 will be presented in the spring of 1960 in New York City. Ten certificates of excellence will also be presented. Deadline for receiving entries is January 20, 1960. An independent committee comprised of experts from industry, the government, education, and the trade press selects the winners.

(Circle 15 in Readers' Service Dept.)

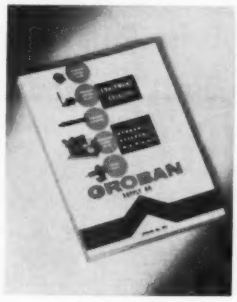
ELECTRONICS–Special emphasis has been placed on electronic equipment for industry, with the 1960 catalog just released by Allied Radio Corporation. Allied's new 528-page catalog, which includes 232 pages in rotogravure and 4-color covers, lists over 40,000 items, the largest catalog published by any electronics supply house, it is claimed. The catalog includes extensive listings of parts and equipment for industrial maintenance, research and production requirements. Of interest to the industrial purchaser, are such features as immediate delivery from stock, factory prices and quantity discounts.

(Circle 16 in Readers' Service Dept.)

STEEL–A booklet on a high strength steel for use in aircraft, missiles, and rockets is now available from Allegheny Ludlum Steel Corporation. The booklet, entitled "Potomac A High Strength Steel," is 24-pages long, and contains numerous graphs and charts on this chromium-molybdenum-vanadium hot work steel. The steel, known as type H-11, is noted for its high strength up to 1000 degrees F. and is used in landing gears, solid propellant rocket cases, structural sections of aircraft and missiles, and many other applications, according to the manufacturer.

(Circle 17 in Readers' Service Dept.)

EQUIPMENT–Hundreds of newly manufactured and surplus industrial items are fully illustrated in a new 60-page catalog published by the Groban



Supply Company. A special section is devoted exclusively to hydraulic equipment. Other sections deal with the construction, diesel, automotive fields, etc. The catalog is claimed to include equipment used for original manufacture or maintenance in every conceivable industry. Each item is illustrated and described with engineering specifications, technical drawings, suggested usages, etc.

(Circle 18 in Readers' Service Dept.)

ROPE–Seven products of the Wire Rope Division of Jones & Laughlin Steel Corporation are described in five separate, 4-page pamphlets just published. The products are: Centerfit Wire Rope; Cable Laid Slings; PlastiKore and SpringKore Wire Rope; JalKlamp and JalLoc Slings, and Oil Field Manila Rope. Each pamphlet describes the various applications for which the product is best suited. Specifications for strength and size are listed in tables. A brief guide on how to order wire rope is presented in the booklets covering these products. Proper application of the products is stressed in support of the national "Safety in Lifting" program now being carried on by J&L's Wire Rope Division. Highlighted through photographs are the stringent testing procedures developed by J&L's wire rope experts.

(Circle 19 in Readers' Service Dept.)

MECHANICAL SEALS – A bulletin describing some common causes of failure of mechanical seals on pump shafts in water systems has been published by Water Service Laboratories, Inc. The literature relates abrasive action to the longevity of the seal and describes the importance of proper alignment of the pump and drive shaft to the life expectancy of the seal. Results of exhaustive tests, reports the bulletin, show that the chemical content of treated circulating water has no adverse effects on the seal.

(Circle 20 in Readers' Service Dept.)

OPTICAL–A 25-page illustrated catalog, "Optical Tooling and Industrial Alignment Equipment," has been issued by Keuffel & Esser Company. The catalog covers the complete K&E line of equipment for production tooling, machine alignment, quality control, and inspection. Technical descriptions and specifications for all equipment are provided. Equipment shown and described in the new catalog includes: jig transits, alignment telescopes, collimators, sight levels and line of sight telescopes. Also: instrument testing equipment, surveying instrument micrometers, instrument stands; lamp housings, mounting accessories and brackets; target holding and centering equipment, and scales, tapes, targets, and mirrors.

(Circle 21 in Readers' Service Dept.)

SCAFFOLDS–A 16-page brochure on Baker portable steel scaffolds is now available. It illustrates the versatility of the single Baker scaffold unit as well as the numerous set-ups possible with multiple Baker scaffold units to provide higher, wider or longer work platform areas. Baker scaffolds assemble easily and rapidly to form a safe, rigid work platform which is adjustable in 3-inch increments from a minimum of twenty-two inches to a maximum of 5-feet-8 inches (plus caster heights), according to the manufacturer. Platform heights may be changed quickly and easily by manually releasing the special spring-loaded catch which provides automatic locking.

(Circle 22 in Readers' Service Dept.)

These listings are informational only and are not an endorsement of the products, nor of the manufacturer's claims. To receive any of the new literature described in this column, merely circle the item number in the Readers' Service Dept. and mail to AMERICAN ENGINEER.

NSPE Gains 51st Affiliate, Plus First Student Chapter

- Society Holds Fall Meet in Pittsburgh
- Mosher Outlines Four-Point Program

NSPE, moving towards its goal of 60,000 members by 1960, gained its fifty-first state-level affiliate and its first student chapter at its annual fall professional meeting in Pittsburgh last month.

More than 300 directors and members were on hand to see Vermont become the Society's fifty-first affiliate at the opening night's dinner meeting in the Penn-Sheraton Hotel.

President Harold A. Mosher accepted the petition for affiliation of the Vermont Society of Professional Engineers from Paul R. Krauss, of Burlington, Vermont, a General Electric engineer who is the first president of the new society. After acceptance of the petition, Walter D. Emerson, a member of the engineering faculty at Norwich University, was seated as Vermont's national director.

Earlier, the University of Pittsburgh became the nation's first student chapter to become officially affiliated with the National Society. Victor J. Steigerwald, president of the chapter, accepted the charter from Mosher in ceremonies following the opening dinner.

In a brief speech following the presentation, J. Neils Thompson, chairman of the Society's Student Chapter Committee, described the student chapter program as "something that will pay big dividends in the long run. I hope this presentation here tonight is the forerunner of many such presentations," Thompson told the directors.

Acceptance of the two new chapters—both evidence of Society growth—tied in closely with President Mosher's four-point program for 1960 which he outlined to the Board on opening night.

He urged renewed activity by the Society in the areas of (1) membership; (2) public relations; (3) unity, and (4) the grass-roots approach to the activity of the three levels of the Society structure.

"We must organize our efforts to implement the Society's goal of 60,000 members in 1960," Mosher told the directors. "A twenty per cent increase may seem like a lot, but if we are to maintain our growth we must step up our efforts."

In the field of public relations, Mosher urged the directors to move forward with "a vital, effective and purposeful program to reach the scores of publics with which we are concerned. One of the best possible programs would be to make each of our 50,000 members a personal public relations agent.

"More of our funds will have to be given to this very important field of public relations," Mosher said.

Mosher also pointed to the long-standing problem of unity as another field which must receive increasing attention from the membership in 1960.

"No wonder the public doesn't understand us . . . it's hard to explain how it is possible for 100 different societies to be speaking for the engineering profession," Mosher said.

"We must remain flexible enough (on the question of unity) to move in the direction that will provide the greatest benefit for the profession, but we must be equally careful not to abandon principles which would result in our being led down the wrong path," he told the Board.

He also asked that the directors make efforts to strengthen the grass-

First Student Chapter

NSPE gained its first student chapter during its annual fall meeting in Pittsburgh last month. Here President Harold A. Mosher (second from the right) and Victor J. Steigerwald, president of the University of Pittsburgh Chapter, pose with the charter of the new group. At the far left is Frank Myers, president of the Pennsylvania SPE. On the right is J. Neils Thompson, national director from Texas and chairman of NSPE's Student Chapter Committee.

roots approach in the operation of the Society's three-level structure of local, state and national activity.

Communications, Mosher said, is one of the biggest problems in making the three-level program work. He urged the directors to increase their "face to face" contact on the local levels in improving the communications between the three levels.

"There are many other areas which will demand our energies in the coming year," Mosher said. "In fact there is hardly a program that doesn't offer a big challenge for us.

"Leadership doesn't come cheap . . . it brings higher demands and we must be willing to pay the price of leadership," Mosher said.

Later the directors approved a budget of $680,400 for 1960 which included increased expenditures in many of the areas outlined by Mosher.

The budget provides for five additional clerical employees in the headquarters staff; sixteen additional pages for the AMERICAN ENGINEER; funds for a new survey by the Professional Engineers Conference Board for Industry, and increases for various committee activities including the addition of two staff employees to implement committee work.

At the request of A. C. Friel, chairman of the Engineering Technicians Committee, the Board went on record in favor of NSPE developing a certification procedure for technicians. Friel said his Committee was not yet ready to ask for actual implementation of the program and asked only for Board approval for the Committee to develop details of a certification procedure to be presented to the Board later.

The directors, at the same time, officially announced that they would make no attempt to foster legislation setting up legal qualifications for engineering technicians. However, they said the Society would cooperate with technical institute programs on the "same pattern that now exists with the engineering college programs."

On the question of unity, Garvin H. Dyer, chairman of the Inter-Society Relations Committee, announced plans for the mailing of a questionnaire early in 1960 in an effort to obtain grass-roots opinion on the subject. The questionnaire will cover (1) fundamental questions relating to unity, and (2) fundamental questions relating to NSPE opening its membership to nonregistered engineers who are otherwise qualified by their holding suitable grades of membership in those societies which subscribe to ECPD Uniform Grade Membership Standards.

A summary of the Society's unity kit, "The Organization of the Engineering Profession," will appear in the January issue of the AMERICAN ENGINEER to provide members with information relating to the questionnaire.

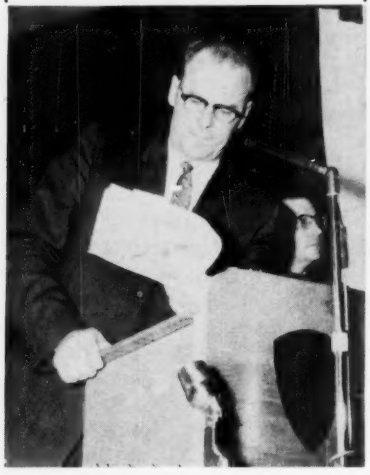
Dyer also urged that the directors make efforts to implement the Committee's Recommendation No. 7 adopted at the annual meeting in New York in June. The recommendation states that "NSPE immediately establish a closer liaison with the founder societies with the objective of every member of NSPE joining and supporting the work of the founder society which serves his particular field of practice and of every registered member of the founder societies joining and supporting the work of NSPE. . . ."

Acting on the recommendation of the Committee on Engineering Preparation, the Board urged its local chapters to organize engineers' committees on secondary schools to evaluate the needs of education in science and mathematics. The Committee said that in some areas "engineers might be the only group of citizens qualified to evaluate educational needs in science and mathematics and to speak understandingly on the subject."

The report also pointed to the responsibility for community leadership on the part of professional engineers in conducting surveys and advising schools and citizens' organizations in matters relating to educational needs.

The Board also approved a resolution calling for the Atomic

NSPE Veep



Vice President Brandon H. Backlund clears up a point during discussion of a committee report. Standing behind him is A. C. Friel, chairman of the Committee on Engineering Technicians.

W. Earl Christian, vice president, presides over a discussion of the 1960 budget for NSPE. At the right is Paul H. Robbins, executive director of the Society.

Arizona Director

J. H. Stufflebean, national director from Arizona, raises a point from the floor at the Pittsburgh meeting. More than 300 directors and members attended the three-day session in the Penn-Sheraton Hotel.

Past President Garvin H. Dyer (right) talks with Harry P. Cooper, of Texas, chairman of the Engineers-in-Industry Subcommittee at the Society's annual fall meeting in Pittsburgh.

Illinois directors at work during a Board session. From left to right are C. J. McLean, William S. Gray and Melvin E. Amstutz.

Energy Commission to divorce its construction costs from engineering costs in the negotiation of contracts. The resolution was originally submitted to the Board by the Washington Society of Professional Engineers and later approved by the Functional Section for Consulting Engineers in Private Practice.

A second resolution submitted by the Minnesota Society called for the encouragement of the use of registered engineers by the Federal Government. It was referred to the Employment Practices Committee for recommendation.

Also referred to committee was a move by Director Joseph Dannenbaum from Texas to have the Society student chapter program expanded to include any student chapter organized within the framework of any state society. The Student Chapter Committee was instructed to report on the question at the Board's next meeting in Wichita, Kansas, in February.

It wasn't all committee reports and business at the meeting. The directors were guests of the Pennsylvania SPE for two social hours, a dinner and banquet during the three-day session. Wives of the directors had their own program on Thursday and Friday including entertainment, tours and luncheons.

Criticizes Math Teaching

During the annual fall meeting in Pittsburgh, NSPE President Harold A. Mosher took time out to level sharp criticicism at the preparation of high school students in mathematics.

"We are babying our high school students in basic mathematics to the point where it takes two to three years of college courses before they are brought up to a level where they should have been at the end of the twelfth grade," Mosher said.

"I believe every American high school today should offer courses in algebra, plane and solid geometry, trigonometry, and the calculus. There is no reason why high school seniors with a good preparation in basic math cannot be introduced to differential and integral calculus. A background in mathematics is essential for any study of the physical sciences. We are definitely limiting the full utilization of our brainpower resources by not insisting on sound training in mathematics in our high schools throughout the country.

"In all walks of life one can hear Americans say, 'I never was good in math.' What these people really mean is that they never had a sound, step-by-step foundation in the principles of mathematics. Mathematics is like the top rung of a ladder; you cannot get to it without using the lower rungs."

Vermont Becomes 51st Affiliate

Vermont became the fifty-first state-level affiliate during the meeting. Paul R. Krauss, of Burlington, Vermont, (left) holds the petition of the new group. President Harold A. Mosher (right) accepted the petition in behalf of NSPE. Walter D. Emerson (center) was sworn in as the first national director from the State.

William J. Parish was general chairman and David J. Camilli, co-chairman for the meeting. Other chairmen included Donald M. McNeil, Exective Committee; Russell M. Jenkins, Publicity; Donald C. Peters, Sponsors Committee; Robert A. Blackburn, Speakers Committee; Mrs. Byron Keim, registration; Alfred Danzilli, hotel arrangements; Edward L. Scanlon, program and printing; Edward Stoltz, finance, and W. H. McDermott, entertainment and reception. Mrs. William Wachter served as general chairman of the ladies program.

Plan Broad Government Survey

A broad survey of state civil service and merit system regulations relating to engineering personnel policies will be launched by NSPE's Functional Section for Engineers in Government Practice.

Plans for the survey were outlined to the NSPE Board of Directors by Wesley E. Gilbertson, chairman of the Section, during the Board's meeting.

"The Functional Section believes such a study to be extremely meritorious in that it will serve to focus the attention on all areas of state engineering personnel administration so that more improved policies and higher standards will result," Gilbertson told the Board.

The survey, he said, will be carried out in cooperation with the functional sections of the state societies. Plans are also underway to extend the survey to include engineering personnel policies in the major municipalities.

Already under scrutiny are the personnel policies in New York City where professional engineers are seeking a modification of Administrative Order No. 49 in an attempt to gain greater safeguards against unionization of the city's professional employees. Members of the New York State Society are scheduled to meet with Mayor Robert Wagner on November 9 to discuss amendments to the 1956 order. The NSPE Functional Section has gone on record as "fully in accord" with the efforts of the New York City engineers.

Gilbertson also announced plans for the appointment of a special committee to meet in November with Rocco C. Siciliano, special assistant to the President on personnel, to discuss Federal classification legislation. NSPE is backing legislation which would establish separate classification and pay schedules for engineering and scientific personnel. The Administration has indicated opposition to the proposed bills.

Also on the national level, Gilbertson said the Functional Section will continue "to impress upon the Civil Service Commission and other agencies of the Government the desirability of recognizing registration as a significant qualifying standard for engineering personnel."

Gilbertson pointed to the recent registration of 400 of the 628 engineers in the Denver Engineering Center of the Bureau of Reclamation as an example of success of the program in Federal agencies. "This record was achieved with the active work of many persons and groups particularly the Professional Engineers of Colorado and the State registration board," Gilbertson told the directors.

In connection with its policy of encouraging registration of government engineers, the Section is planning the publication of a pamphlet outlining the desirability of registration of engineers at all levels of government, Gilbertson announced.

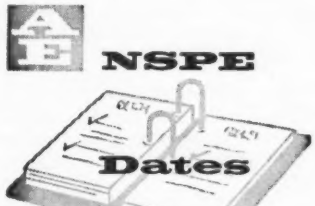
The other half of the Society's functional section program—engineers in private practice—received Board approval for an interim financing program to supplement NSPE budget allocation for 1960. The Board suggested that consulting engineering firms make contributions based on five dollars per registered engineer in each firm.

A new task force—Task Force No. 5—reported substantial returns on its request for information to meet Congressional criticism of the use of consulting engineers by Federal agencies.

Alfred H. Samborn, chairman of the Section, announced that questionnaires have already been mailed to 463 consulting firms in an effort to obtain detailed information on fees and other matters relating to the question. The information will provide the background for the Society's presentation before Congressional committees which plan to take up the question of the use of private engineering firms by various Federal agencies early next year.

"It is not the intent of this Task Force or the Executive Committee that the results of this effort will in any way advocate that governmental agencies abolish their own engineering services; however, we do anticipate that the presentation will point up the need for a balance of free enterprise, especially to handle peak load situations," Samborn said. "We also feel that it will point out the advantages that accrue to the engineers in government in these Federal agencies because of the existence and use of consulting firms," he said.

Samborn also announced that his Section is planning to continue support of the Keogh-Simpson self-employed retirement bill through the American Thrift Assembly. The bill has passed the House and is now awaiting action by the Senate.



to Remember

North Dakota Society of Professional Engineers—Annual Meeting, November 5-7, 1959, Gardner Hotel, Fargo, North Dakota.

Washington Society of Professional Engineers—Annual Meeting, November 6-7, 1959, Winthrop Hotel, Tacoma, Washington.

Professional Engineers of Oregon—Annual Meeting, November 13-14, 1959, Benson Hotel, Portland, Oregon.

Maine Society of Professional Engineers — Annual Meeting, November 14, 1959, Augusta, Maine.

Arkansas Society of Professional Engineers — Annual Meeting, November 27, 1959, Marion Hotel, Little Rock, Arkansas.

Puerto Rico Society of Professional Engineers—Annual Meeting, November, 1959, Building of the Colegio de Ingenieros, Hato Rey, Puerto Rico.

National Society of Professional Engineers—Winter Meeting, February 18-20, 1960, Broadview Hotel, Wichita, Kansas.

National Society of Professional Engineers—Annual Meeting, June 8-11, 1960, Statler Hotel, Boston, Massachusetts.

TV Spot Films Available to Promote '60 Engineers' Week

Five TV spot films dramatizing the theme of the 1960 National Engineers' Week will be available to all NSPE groups.

A set of three 1-minute and two 20-second films has been produced for the Engineers' Week Committee for use on public service TV time. The 16mm films call attention to the role of the engineer in facing the challenges of the 1960's.

Mackinac Bridge

An early stage in the construction of the Mackinac Bridge as shown in the U.S. Steel film, "Mackinac Bridge Diary."

Voice narration in the films is done by experienced network announcers

The films are available in sets of five 16mm prints from the National Society at a cost of $25 per set. Orders should be placed as soon as possible to allow time for advance screening by local television station program directors.

A set of seven 20-second tape recorded announcements for radio use has been added to the aids offered by the National Society this year. These seven separate announcements, made by a network radio and TV announcer, offer local stations a high-level type of public service message for 20-second station breaks. The spots are recorded on one reel of tape, and may be taken directly to the station program director. A set of the seven recorded announcements may be ordered from the National Society for $3.50.

National Engineers' Week Chairman Belton Y. Cooper has recommended that the set of recorded spot announcements be offered by local chapters to both AM and FM broadcasting stations. "The FM stations should not be overlooked by local Engineers' Week committee chairmen in planning their radio coverage," Mr. Cooper said.

Thirteen leading engineering figures from industry, education, private practice, and government, will act as sponsors of the 1960 National Engineers' Week. The names and titles of the sponsors are listed in the general news section of this issue of the AMERICAN ENGINEER.

Promotional kits for the February observance were mailed in October to all state societies and local chapters. The kits contain samples of the posters, banners, and gummed seals, and suggestions for developing a basic Engineers' Week program. Activities listed in the suggested ideas cover such things as obtaining newspaper publicity, setting up exhibits in store windows and other public places, getting radio and TV programs and announcements, organizing speakers bureaus, and utilizing films for local showing. Each kit contains samples of special newspaper sections obtained by local chapters in connection with the 1959 observance.

Two films will again be available, at no charge, to NSPE affiliates during the 1960 Week. These are "Mackinac Bridge Diary," produced by U.S. Steel, and "American Engineer," produced by Jam Handy for Chevrolet.

The 27-minute U.S. Steel film covers the step-by-step construction of the newly completed Mackinac Bridge across the Straits of Mackinac leading to the upper peninsula in Michigan. It is cleared for TV and may be used on any local station. Appearing in the film is Dr. D. B. Steinman, designer of the bridge, and first president of NSPE. Dr. Steinman is shown signing the engineering report which concluded that "building a bridge across the Mackinac Straits is entirely feasible, both physically and economically." Requests for reservations for the film should be sent to United States Steel, Film Distribution Center, 525 William Penn Place, Pittsburgh 30, Pa.

The 29-minute film "American Engineer" is a tribute to engineers in all fields. Prints of the film should be requested from The Jam Hardy Organization, 2821 East Grand Boulevard, Detroit 11, Michigan.

Cover Design

Cover design for the 1960 National Engineers' Week promotional kits which were mailed in October to all NSPE affiliates. Additional kits may be obtained from Society headquarters.

Promotional Aids for

NATIONAL ENGINEERS' WEEK

HERE ARE the basic promotional aids on which to build your Engineers' Week program. These items will give your program coverage in local newspapers, on radio and TV stations, and in civic and group displays. Use these promotional materials to show how engineering progress will affect the decade of the 1960's.

1 ***TV Spot Films:*** A set of three 1-minute and two 20-second TV films dramatizing the theme of the 1960 National Engineers' Week. Produced to meet network standards, the films call attention to the role of the engineer in building for progress through the coming decade. Each film qualified for public service TV time during station breaks. A set of these five films will reach your largest Engineers' Week audience. Price: Set of five films, $25.

2 ***"Engineering's Great Challenge—The 1960's:"*** A 15-minute tape recorded radio program dramatizing the contributions engineering will make during the 1960's. Network performers describe engineering achievements in exploring the moon, in building computers, in medical research, in designing new transportation arteries, in structures, and in many other fields. Excellent for use on public service radio time. Price: $6 each.

3 ***Set of Seven TV Slides:*** Obtain extensive TV coverage through the Week with these slides displaying poster-type art work and printed copy calling attention to engineering. May be used during all TV station breaks as public service announcements. Price: $10 per set of 7 slides.

4 ***Tape Recorded Radio Announcements:*** A set of seven 20-second radio spot announcements, made by a network radio and TV announcer. Offers local stations a top-level recording for 20-second station breaks. Price: Set of seven recorded announcements, $3.50.

5 ***Lapel Buttons:*** A high-quality lapel badge with poster design. Each chapter or state society can set its own price for button sales. Prices: 100 to 500—15c each; 500 to 1,000—10c; 1,000 to 3,000—7c; 3,000 to 5,000—5c; and over 5,000—4c.

6 ***Posters:*** Colorful 9 x 11-inch pasteboard posters carrying the 1960 Engineers' Week design and theme. This is the basic promotional item for calling attention to the Week. Use on bulletin boards, in window displays, school exhibits, etc. Large size (18 x 22 inches) also available. Prices: 9 x 11, $4 per 100; 18 x 22, $5 per 100.

7 ***Paper Banners:*** Excellent for display use. Three feet long by 6 inches wide. Has poster design and words "National Engineers' Week" in color. Price: $4 per 100.

8 ***National Engineers' Week Seals:*** Use these brightly colored seals on all office mail from now through February 27. Poster design printed on 1½-inch gummed paper. Price: $3 per 1,000.

9 ***Newspaper mat story on engineering and the exploration of the moon during the 1960's:*** A feature article on how the exploration of our moon will be an engineering accomplishment from the rocket vehicles, through the instruments and structures landed on the lunar surface. Prepared on mat, with illustration, ready for immediate insertion in daily or weekly newspaper. Price .75 each.

10 ***Newspaper mat story on the engineering achievements expected in the decade of the 1960's:*** A feature article on engineering progress, based on the engineering "breakthroughs" of the 1950's. Prepared on mat, with illustration, ready for immediate insertion in daily or weekly newspaper. Price .75 each.

11 ***Logotype:*** A metal cut of a poster design to insert in advertising, special sections of newspapers, industrial house organs, magazines, and other printed matter. All state society and chapter publications should have one. Price: $1 each.

12 ***"Engineering . . . for the Age of Space:"*** A re-issue of the 15-minute tape recorded radio program distributed last year. Excellent for use on public service radio time. Price: $4 each.

→ *Use this coupon to order your aids now!*

National Society of Professional Engineers
2029 K Street, N.W./Washington 6, D. C.

Sirs:

Please rush me items indicated. I enclose a check ☐ money order ☐ in the amount of $.....

I understand remittance must accompany order.

NAME _____
Please Print

ADDRESS _____

CITY _____ STATE _____

1._____TV Spot films @ $25 per set.
2._____Radio tape "Engineering's Great Challenge—The 1960's" @ $6 each.
3._____TV slides: set of 7 slides @ $10 per set.
4._____Recorded spot announcements @ $3.50 per set.
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Thoughts on Professionalism...

By PAUL H. ROBBINS, P.E.
NSPE Executive Director

Are We Helping Qualified Engineers to Become Registered?

The Society at all levels should immediately expand upon and pursue more active and aggressive programs of education in the merits and values of registration and of providing personal assistance to all qualified nonregistered engineers in becoming registered. (Board Action 59-85)

ALL members of NSPE have had, no doubt, the experience of talking to a qualified engineer who has failed for one reason or another to become registered. It is not uncommon to receive from him the reaction, "I have been away from my theory so long I could never pass an examination." It is interesting that so often the tone of the response clearly indicates a wishfulness that he had not put off taking this important step. Most frequently this reaction comes from older engineers. Too often it is predicated upon an impression or secondhand knowledge of either the registration law or its administration and is not, many times, backed up by the actual requirements. The great bulk of the profession has now come to recognize that registration is a means of solving one of the profession's most perplexing problems; namely, that of defining who is an engineer.

WHILE it is true that some states have moved forward to the point that few, if any, licenses are granted without at least an oral examination a survey reported recently at the annual meeting of the National Council of State Boards of Engineering Examiners indicated that thirty-two of the state registration boards responded that a college graduate of an accredited engineering school over forty-five years of age with satisfactory experience who had never applied for registration before would be registered by those boards with no more than an oral examination. In addition, there were several other boards whose answers were not sufficiently precise to classify, or who had some additional reservations but not requiring a specific written examination. Some of these states, for example, indicated the examination to be taken would pertain only to the man's more specific professional experience.

UNFORTUNATELY, too many members of the Society have not sufficiently informed themselves, since they met the registration requirements in their own case, to determine the current practices of the board or what the requirements of the law may be at this time. While it is true that a number of chapters are either directly sponsoring or cooperating with other organizations in the sponsorship of refresher courses, much more could be done to assist qualified engineers in attaining registration. At least one chapter has set up a very effective counseling committee, the members of which have extensively informed themselves on the requirements of the board and the law and are helping numerous engineers to fill out their application forms and to write up their experience to clearly indicate to the board the responsibility and actual work accomplished by the applicant.

IT is the responsibility of those who have met these qualifications to assist any others who meet the minimum qualifications established by the law to present these qualifications in such a way that the board understands fully the background and abilities of the applicant. Chapters could do well to make this one of their primary responsibilities in the area in which they serve.

LABOR BILL

(Continued from page 50)

deniably would, be forced to be represented by and join a heterogeneous labor organization contrary to their wishes and contrary to the existing language of the Taft-Hartley Act."

NSPE's Executive Director Paul H. Robbins told the House Committee that the intent expressed in the Senate Committee report should be carried into specific legislative language in order to avoid possible misunderstanding or doubt on the point. Without the protection of a Board certification, professional employees are completely at the mercy of employer-union agreements, and we can see only too plainly a situation in which professional employees may become the pawns in the chess game of collective bargaining," he said.

Although the labor reform bill as finally reported out by the House Committee contained a "construction industry" provision similar to that in the Kennedy-Ervin bill, NSPE's efforts undoubtedly were instrumental in leading the House Committee to declare that the "construction industry" provision in its bill was not intended to affect the rights of professional engineers. This statement was practically identical to that contained in the Senate Committee report on the Kennedy-Ervin bill.

Even though the statements of intent appearing in the respective committee reports were highly encouraging and rewarding for NSPE's efforts, the Society nevertheless continued at every opportunity to urge the adoption of specific wording in the bills themselves in order to give force and effect to these statements of intent, and to eliminate the possibility of doubt or confusion at a later date.

SHORTLY after the appearance of the House Committee bill, Representatives Landrum and Griffin introduced identical measures which contained a "construction industry" provision which NSPE viewed as being more acceptable

from the professional engineers' standpoint than any other previous version. The Landrum-Griffin bill provided for NLRB certification of unions in the construction industry without a prior election, but would have limited certification to "such unit as the Board may find is normally represented by the labor organization." NSPE's detailed analysis of this section indicated that the quoted language would protect professional engineers from being included in the certified unit against their express desires, inasmuch as they are not normally represented by building trades unions.

On the basis of this understanding, NSPE informed both Representatives Landrum and Griffin of the Society's strong support of their version of the "construction industry" amendment. In addition, NSPE called upon all state societies, chapters and individual engineers to contact their Representatives urging support of the Landrum-Griffin approach as the preferred method for dealing with problems in the construction industry.

On August 13, 1959, by a vote of 229 to 201, the Landrum-Griffin bill was substituted for the text of the Committee-approved bill, and on the following day, a final vote approved the measure by a count of 303 to 125. The Kennedy-Ervin bill and Landrum-Griffin bill then went to conference to resolve differences between them.

During the course of the twelve days' deliberations by the conferees, NSPE was not idle. Letters were sent to each of the conferees urging the Senate spokesmen to accede to the Landrum-Griffin "construction industry" version, and the House spokesmen to hold the line.

At one time during the conference meetings, it was agreed to eliminate the "construction industry" provision completely, but upon the strong insistence of Senator Kennedy, the conferees later decided on the Senate version. The bill as agreed to by the conferees was approved rapidly by both the Senate and House, and sent to the President for his signature.—**End.**

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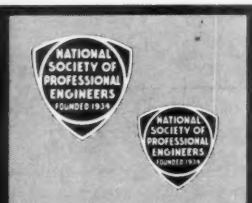

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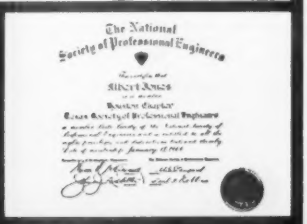

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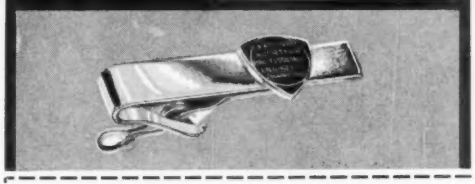

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As November is Young Engineers' Month, the National Society has recently distributed a working kit for state and chapter officials to aid them in scheduling programs.

Accompanying the kit was a memorandum from Arthur Gompf, chairman of the Young Engineers Committee, requesting all of the states and chapters receiving the publication to not only use it in observance of the special month, but also on a year-around basis.

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1. The names and addresses of the publisher and editor are: Publisher, National Society of Professional Engineers, 2029 K Street, N.W., Washington, D.C., Editor, Kenneth E. Trombley, 2029 K St., N.W., Washington, D.C.

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KENNETH E. TROMBLEY, Editor

Sworn to and subscribed before me this 24th day of September, 1959.
(SEAL) MILTON F. LUNCH
(My commission expires September 14, 1962)

By Mrs. Garvin H. Dyer, Chairman of the Ladies Auxiliary Advisory Committee.

Congratulations go to the Riverside-San Bernardino Chapter of California for organizing a new auxiliary. This group of women officially organized during the summer, with the assistance of Mrs. George Werner, president of the Pasadena, Calif., Auxiliary, one of our most active auxiliaries. Mrs. Richard Holmes was elected president at the first regular meeting in September. A membership tea was held in September.

Aside from helping the new auxiliary to organize, the Pasadena Auxiliary has been busy with its annual summer family picnic, and a luncheon at the Huntington in September. The group has a very interesting year of activities planned.

The Fresno Chapter Auxiliary of California had its first meeting on September 21 at Wonder Valley Dude Ranch. Yearbooks were presented to the members.

Three chapters in West Virginia —the New Martinsville, Weirton, and Wheeling Chapters—served as hosts to the State Silver Anniversary convention on October 8-10.

The Fairfield Chapter Auxiliary of Connecticut reports a successful membership tea at the Bridgeport University Club. Eighteen new members were welcomed into the Auxiliary. Members attended the first joint State evening and barbecue party held at Holiday Hill, Cheshire, Conn.

The Hartford Chapter Auxiliary and the New Haven Chapter Auxiliary of Connecticut are preparing for their scholarship fund projects.

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MERGING

(Continued from page 47)

are those who would move completely in the direction of having a curriculum made up of science, mathematics, engineering sciences, and the humanities, leaving out completely the engineering analysis and design. Curricula which have emerged along these lines are named engineering physics, engineering science, etc.

On the other hand, some educators say that the trend to emphasis upon science has already moved too far. This group maintains that engineering analysis and design, the portion of the curriculum which really directs the student toward engineering, have been sacrificed. They would re-emphasize this important element.

The resolution of this problem remains yet to be seen. One group advocates a five-year curriculum, leaving the engineering analysis and design to the fifth year and increasing the science and mathematics content to the first four. Others advocate offering two kinds of curricula; one to be predominantly science and engineering science, directing the individual toward a research career, or an engineering job close to science, a second to retain the elements of engineering analysis and design in a stronger sense than at present, directing the individual toward a practicing engineering career. The largest group of engineering educators seem to feel that we need both. This is where my own convictions lie. I would by no means abandon the engineering education program leading to the general practitioner type of engineer in favor of the education program leading solely to science.

In summary, I cannot join the hue and cry that science and engineering have become or will become one. I think that engineering and science have long slept in the same bed, and I see no reason for change. To the contrary, the bond of teamwork and mutual dependence has recently been emphasized more deeply because of evolving characteristics of man's increasing command over the universe in which he lives.

Although I recognize our great need for more scientists and for an emphasis upon scientific concepts in the general educational background of everyone, I also recognize similar needs with respect to engineers and engineering. I feel that the importance of the engineer and his unique place have been overlooked and de-emphasized. As an engineer, I think all engineers should speak out on this subject so that the general public does not infer that engineering is losing its identity in science. I, for one, do not believe that it is.—**End.**

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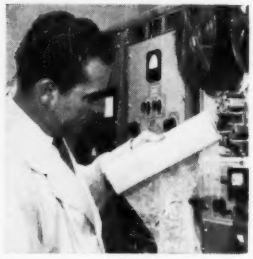

A nonwoven, scratch-free fabric designed to pick up and hold dust has been introduced to industry by Minnesota Mining and Manufacturing Company. Called "Scotch" brand dusting fabric No. 550, this thin material—neither a cloth nor a paper—can collect dust from even the most detailed precision instruments, electronic equipment and cabinets, etc., it is claimed.

GIANT CAMERA — Item 31

Capitol Reproductions Inc. has recently put into operation a custom-built process camera capable of handling copy as large as a 6′ by 20′ engineering drawing. It is said to be the largest commercially available camera of its type in the country. Some of the applications of this new camera are the making of shrink factor expansions for casting molds and scale reductions for miniature models, styling and archives; optical comparators and reticles, printed circuitry, maps and murals, and such special applications as making symmetricals and opposite views.

OFFICE COPIER — Item 32

Haloid Xerox Inc. has announced its entry into the office copying field with the introduction of the Xerox 914 Copier. The machine copies all colors and makes single or multiple copies of original documents up to 9-by-14 inches in size automatically. Without handling the copy paper or rehandling the original, the operator makes any number of maximum quality copies on ordinary paper simply by dialing the number desired and pushing a button.

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SURVEYING — Item 34

Path surveying instruments, a new line of surveying transits and levels, are now being distributed by Charles Bruning Manufacturing Company, Inc. The Path line includes 4″ and 6″ (see photo) transits, transit levels, dumpy levels, eye levels, tilting levels, and pocket levels. Bruning will continue to distribute Brunson instruments while handling the Path line.

PLASTIC — Item 35

A tough plastic that can be engineered precisely has been developed by the Naugatuck Chemical Division, United States Rubber Company. Kralastic MM, the new material, is a resin-rubber blend specifically designed for molding products where high rigidity and resistance to cold flow under loads are required. A medium-impact plastic, lab tests indicate it is more rigid and has less tendency to creep, or flow, under load than any thermoplastic material now being marketed. Its rigidity is about twice that of nylon, and its resistance to creep is four times greater, it is claimed.

PORTABLE KEYBOARD — Item 36

A lightweight portable 10-keyboard has been announced by the Victor Adding Machine Company. The keyboard has broad applications to both business and industry for all types of remote numerical transmission and inventory work. Information is entered serially as with any standard 10-key accounting machine. Receiving the data may be a Victor Digit-Matic adder, calculator, printer, any solenoid activated business machine, tape punches, or other electronic data recording device which can supply required voltage.

PAINT PROCESS — Item 37

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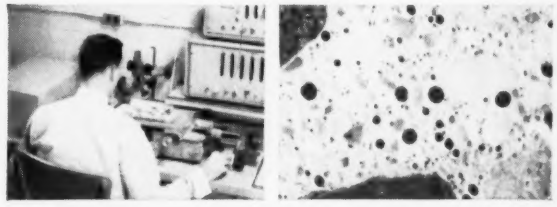

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